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NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN ANNEX I TO THE CONVENTION

MATTERS RELATED TO THE CONSIDERATION OF NON-ANNEX I PARTY COMMUNICATIONS

First compilation and synthesis of initial communications from Parties not included in Annex I to the Convention

Note by the secretariat

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Explanatory notes

References to UNFCCC guidelines are to document FCCC/CP/1996/15/Add.1, decision 10/CP.2, annex: "Guidelines for the preparation of initial communications by Parties not included in Annex I to the convention". The Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories are referred to in this document as the IPCC Guidelines. Text in *italics* indicates source/sink categories of the IPCC Guidelines.

Details and percentages in tables and figures do not necessarily add to totals, due to rounding.

The following chemical symbols and abbreviations have been used:

CF_4	tetrafluoromethane
C_2F_6	hexafluoroethane
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
N_2O	nitrous oxide
NO_x	nitrogen oxides
NMVOCs	non-methane volatile organic compounds
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide

The following units of weight have been used:

Gg	gigagram (10^9 grams)

The following other abbreviations have been used:

GDP	gross domestic product
GHG	greenhouse gas
GNP	gross national product
GWP	global warming potential
LUCF	land-use change and forestry

The following ISO country codes have been used:

Argentina	ARG	Federated States of Micronesia	FSM
Armenia	ARM	Republic of Korea	KOR
Jordan	JOR	Senegal	SEN
Kazakhstan	KAZ	Uruguay	URY
Mauritius	MUS	Zimbabwe	ZWE
Mexico	MEX		

I. EXECUTIVE SUMMARY

1. The first compilation and synthesis of initial communications from Parties not included in Annex I to the Convention is based on 11 communications received by 1 June 1999: Argentina, Armenia, the Federated States of Micronesia, Jordan, Kazakhstan, Mauritius, Mexico, the Republic of Korea, Senegal, Uruguay, Zimbabwe. These Parties span a wide range in terms of geographical spread, natural resource endowment and level of economic development. The widely differing national circumstances of the Parties that reported, the relatively small number of submissions, and their differing coverage of key issues make it difficult to identify significant trends. However, several common issues are raised in the communications: first, the Parties stress the importance of national circumstances and development priorities in the identification of measures being considered; second, they clearly indicate their needs and constraints; and, third, activities are at the stage of exploring various options to address climate change and its adverse impacts. In this respect a dominant theme of this compilation and synthesis is the need for better quality of data, improved information flows and scientific research, financial resources and technical expertise, improved methodologies, and institutional development.

2. It is encouraging that all Parties followed the IPCC Guidelines to estimate their national **inventories**, and four of them used the Revised 1996 IPCC Guidelines. The majority of them also submitted the worksheets required by the IPCC. These worksheets provide information for replicating the inventories that were developed with the IPCC default methods and therefore contribute to the transparency of the inventories. The completeness of reporting in terms of IPCC greenhouse gas source categories and major gases (carbon dioxide, methane and nitrous oxide) is approximately at a similar level to that of Annex I Parties.

3. The problems encountered in preparing national inventories are mainly related to the quality and availability of activity data. In some cases, the methods used to estimate greenhouse gas inventories were inadequate and the default emission factors were not appropriate for the Parties' national circumstances. Some Parties updated previous inventories with significant improvements in completeness, transparency and quality. This suggests that there is a clear benefit from preparing inventories on a continuing basis, and a need to maintain and enhance national capacity for this purpose. Parties indicated what was needed to improve and update their inventories, particularly the need for financial and technical assistance that would contribute to capacity building.

4. Carbon dioxide emissions and removals in the energy and land-use change and forestry sectors are generally the most important sources and sinks of greenhouse gas emissions reported by these Parties. However, methane emissions from livestock are the most important source of greenhouse gases for Uruguay. In terms of the sectoral distribution of emissions, fuel combustion is the largest source of carbon dioxide emissions for all reporting Parties except Senegal (where forest and grassland conversion in the land-use change and forestry sector is the largest source). Livestock is generally the most important source of methane for all Parties. Land-use change and forestry constitutes a net sink of carbon dioxide for these reporting Parties,

except for Mexico. The Federated States of Micronesia and Zimbabwe are net sinks, with the sequestration of carbon exceeding total emissions of greenhouse gases.

5. The energy sector grows in significance with economic development, as demonstrated by the Republic of Korea, where carbon dioxide emissions from fuel combustion increased 43 per cent between 1990 and 1994. For most Parties, carbon dioxide from stationary combustion constitutes half to three quarters of aggregate emissions of greenhouse gases. Transport generally constitutes the third or fourth largest source of aggregate greenhouse gas emissions, and is the second largest source of emissions for three of the reporting Parties.

6. Parties noted the relationship of their **national circumstances and development priorities** to climate change and its adverse impacts. All Parties emphasized the need to link climate change concerns with economic development. Most Parties mentioned that the framework for the integration of climate change into national development priorities is either under development or is considered a part of their national environmental action plan, national conservation strategy, or energy conservation strategy. For some Parties, the percentage of the population living in absolute poverty is high. Consequently, maintaining natural ecosystems, building water supply systems, increasing food production, and diversifying the economy (including industrialization and developing the energy sector) emerge as important development priority areas. Parties which provided this information, projected annual growth in energy supply at 4 to 7 per cent till the year 2020.

7. **Sustainable development and integration of climate change concerns into medium- and long-term planning** were discussed in different sections of the communications. Parties provided this information as part of their national development or environment plans, institutional arrangements or national legislation. Most Parties stated that the measures being considered should be in line with long-term policy goals, such as protection of coral reefs, energy security, and combating desertification. All Parties emphasized the need for ensuring an integrated approach between different environmental issues, prioritizing areas where measures should be focused.

8. Parties have undertaken studies on the **adverse effects of climate change** on individual sectors and areas. All Parties expressed the need to develop comprehensive assessments, including analysing cross-sectoral effects and impacts on the poorest and most vulnerable sections of the population. In the agricultural sector, for example, substantial impacts on crop production would affect the food base, particularly for the poorest sections of the population. As for forests, changes in wood growth and difficulties in regeneration would alter the natural ecosystem. Water resources could be affected, with significant economic and social implications. Areas prone to drought and desertification, coastal zones, human health and fisheries, were other examples of adverse effects of climate change identified by Parties.

9. None of the communications presented information on concerns arising from the **impacts of the implementation of response measures**.

10. Parties identified a number of sectors where **adaptation** measures are most important, and stated their intention to implement such measures to deal with the adverse effects of climate change. In agriculture, research on new crops and changed methods of cultivation were emphasized. Changes in the end-use of water and improvements in the management infrastructure were mentioned. The most significant measure in the context of coastal zone management is the building of retention walls and ecosystem protection. The measures have been identified only at a general level. The costs and effectiveness of individual measures in these Parties, potential synergies or negative side-effects have not been studied. Most of the measures reported are in the assessment and planning phase and all Parties emphasized that research was needed to develop response options.

11. Parties expressed the need for assistance to identify specific measures and to assess the effectiveness of such measures. The main needs include information (measurements and data), methodologies (integrated assessment), technical training (to understand and assess climate risk) and institutional development (to determine the economic and social implications of the options and to integrate measures identified into national sustainable development).

12. Parties indicated a range of measures which could contribute to **addressing climate change**. Different approaches were adopted by Parties for identifying measures to address climate change. Some measures were based on quantitative criteria (reducing energy intensity, developing energy performance standards), while others reflected qualitative criteria based on the Parties' development priorities (energy technology development, renewable energy, modernization of power stations, and measures to address climate change that double as adaptation measures). In general, Parties are switching away from the use of coal and oil to natural gas and non-fossil fuel energy sources, depending on availability and economic feasibility.

13. Measures to enhance sinks are being taken by all Parties. In addition to conservation and management of forests, Kazakhstan, Mauritius, Mexico, the Republic of Korea and Uruguay indicated that they have adopted targets and timetables for afforestation. The measures reported have been largely financed by international organizations and bilateral agencies, or assistance for that purpose has been received or requested from them. Some Parties identified projects for funding to develop sinks, spread renewable energy technology and improve energy efficiency.

14. Parties have identified possible response options and indicated the need for institutional capacity to develop and operate analytical models to assess the economic and social costs and benefits of the potential measures. Most Parties reported a lack of data in the forest and transport sectors. Mauritius provided a detailed list of options, together with their constraints and implementation challenges. Some Parties have made institutional arrangements to integrate climate change concerns into national action plans and legislation. Also, Parties are exploring the use of economic instruments.

15. Parties are undertaking a large number of specific **research** activities related to vulnerability assessments and options for adaptation, analysis of response measures, and inventories. Many Parties listed the national institutions carrying out research, which is often conducted in partnership with private sector institutions and non-governmental organizations. Parties also described their participation in regional and international programmes, which supplement national efforts. The focus of the studies includes the impact of climate change on various sectors, in particular agriculture, water resources, and energy. Some Parties stressed the need to strengthen these studies with integrated assessments, including estimating costs and benefits of various options to gain a better understanding of what response to adopt. Some also expressed a need to develop institutional capacity for such research activities.

16. Many Parties provided information on **systematic observation and monitoring,** including national meteorological and hydrological networks and activities for monitoring and measuring greenhouse gas emissions and sinks. The level of detail varied widely, however. A number of Parties made specific reference to the need for improved infrastructure. Some also emphasized the application of global circulation models, the development of meteorological technology and the publication of climatic data on a regular basis. Many Parties provided information on cooperation with international and regional programmes, particularly those coordinated by the World Meteorological Organization.

17. All Parties reported information programmes related to **education, public awareness and training**. Educational activities included changes in national curricula to incorporate climate change and environment, dissemination of teaching materials, and the organization of, and participation in, international and/or regional programmes and workshops. Public awareness campaigns consisted of the dissemination of information through diverse materials and means and varied from broad information on climate change and environmental concerns to specific issues such as benefits of certain mitigation and adaptation options, and energy and natural resources conservation. Parties also reported specific technical training activities for governmental policy makers, technical staff and specific sectors of the society. Some Parties reported on the use of the Internet to raise public awareness and education.

18. **Financial and technological needs and constraints** were reported in various sections of the communications. The emphasis is on the development, use and dissemination of data and information. Parties expressed the need for assistance to establish and/or upgrade stations for systematic observation of the climate system and environmental monitoring systems. In order to carry out vulnerability assessments of the relevant sectors of the national economy, several Parties requested assistance in collecting data and developing modelling skills to assess the potential effects of climate change on sectors such as agriculture, water resources, coastal zones, fisheries, human health and natural ecosystems. Studies are also needed for assessing environmental, economic and social costs and benefits of climate change impacts and adaptation measures. On measures to facilitate adaptation, Parties expressed a need to develop institutions for research, monitoring and environmental management. Assistance was requested for sectors such as agriculture, water resources, coastal zone management and natural ecosystems. Parties

also requested assistance for the implementation measures to address climate change. These measures include the development of institutional capacities for research and training to facilitate the transfer of environmentally sound technologies. Assistance was also requested for implementing projects in areas such as energy efficiency, renewable energy, fuel switching, efficient public transport and sink enhancement to abate emissions; and for the development of appropriate regulatory and legislative frameworks.

19. The secretariat was requested (decision 12/CP.4) to report on the problems encountered in the **use of the guidelines**, with a view to further enhancing the comparability and focus of the communications. In their use of the guidelines, Parties covered in considerable detail the areas, sectors and activities on which information was requested. However, the information was not always presented in an accessible form, and information relevant to different sections of the guidelines was often dispersed throughout a Party's initial communication. A structure based on the guidelines has been adopted in this compilation and synthesis, which along with a listing of sectors and the presentation of information in tabular format, facilitates comparison of the information and focus of the document. A more standard presentation of the information in the initial communication along the lines of the table of contents of this document would facilitate the compilation of information. In the future, to facilitate the consideration of the information in their initial communications, Parties may also wish to specify the status of implementation of measures (potential, under consideration, implemented); the costs and effects of measures (impacts on vulnerability, adaptation, and emissions and removals); and areas suitable for transfer of technology. Taking into account any views expressed by Parties, the structure adopted in this document may be modified for the subsequent compilation and synthesis.

II. INTRODUCTION

20. Articles 4.1 and 12.1 of the United Nations Framework Convention on Climate Change require all Parties to the Convention to communicate information to the Conference of the Parties (COP). This provision includes Parties that are not listed in Annex I to the Convention, referred to below as Parties. Article 12.5 specifies that each non-Annex I Party shall make its initial communication within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4.3. Parties that are least developed countries may make their initial communication at their discretion.

21. By its decision 12/CP.4, the COP requested the secretariat to, *inter alia*, compile and synthesize the information provided in initial national communications from non-Annex I Parties, as indicated in decision 10/CP.2, basing the report on submissions received from such Parties by 1 June 1999, and make that report available to the subsidiary bodies at their eleventh sessions and to the COP at its fifth session.

22. Information provided in this document will also serve in supporting the implementation of other COP decisions, particularly those related to technological needs and technology transfer (decision 4/CP.4), the implementation of Article 4.8 and 4.9 of the Convention (decision 5/CP.4), and developments regarding observational networks (decision 14/CP.4).

23. The compilation and synthesis of initial national communications from non-Annex I Parties covers 11 Parties that submitted their initial communication by 1 June 1999:[1]

Submissions

Jan - June 1997	Jordan
July - Dec 1997	Argentina, Federated States of Micronesia, Mexico, Senegal, Uruguay
Jan - June 1998	Republic of Korea, Zimbabwe
July - Dec 1998	Armenia, Kazakhstan
Jan - June 1999	Mauritius

III. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS OF GREENHOUSE GASES

24. Pursuant to Articles 4.1 (a) and 12.1(a), all reporting Parties but one[2] communicated a national inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol. As this report thus covers inventory information from only 10 out of 140 non-Annex I Parties, and taking into account the very different and particular national circumstances of those Parties, the analysis presented here does not draw general conclusions on common patterns of the reporting of inventory data by the group of non-Annex I Parties as a whole. The focus is on relevant methodological issues, to provide a general picture of how the data requirements have been addressed by the reporting Parties. The conclusions provided here may also be useful for Parties that are in the process of preparing their initial national communication.

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[1] In addition, Argentina, Jordan and Uruguay submitted updates to their communications or updated parts of their communications, such as their national GHG emission inventories.

[2] The Federated States of Micronesia are not included in the analysis of this section, as the national communication did not include a GHG emission inventory. The national communication stated that the country's GHG emissions represent a negligible percentage of the world's total GHG release, and that it can be assumed that, because of the sink capacity of its extensive forests and coral reef systems, the country may provide a net uptake of GHGs.

A. Main findings

25. CO_2 emissions and removals from *the energy* and *land-use change and forestry* sectors are generally the most important sources and sinks of greenhouse gas emissions reported by Parties. CH_4 emissions from livestock are the most important source of greenhouse gases for Uruguay. *Fuel combustion* is the largest source of CO_2 emissions for all reporting Parties, except Senegal (*where forest and grassland conversion* in the *land-use change and forestry sector is the largest source*). Livestock is generally the biggest source of CH_4. *Land-use change and forestry* constitutes a net sink of CO_2 for all reporting Parties, except Mexico.

26. All Parties followed the IPCC Guidelines to estimate their inventories, mostly using the default methods, and four of them used the Revised 1996 IPCC Guidelines, as encouraged by relevant conclusions of the Subsidiary Body for Scientific and technological Advice (SBSTA). Six Parties provided national GHG inventories for the year 1994 and three for 1990. In addition, three of the reporting Parties provided inventory data for both 1990 and 1994. Mauritius reported its inventory for the year 1995.

27. The completeness[3] of reporting in terms of IPCC GHG source categories and major gases (CO_2, CH_4 and N_2O) is approximately the same as that of Annex I Parties. In some sectors, for example *land-use change and forestry*, the degree of completeness exceeded that of Annex I Parties. In other sectors, such as *industrial processes*, the degree of completeness relative to Annex I Parties was lower (see table 2).

28. All Parties reported data on GHG precursors. Approximately half of the Parties reported emissions from bunker fuels and aggregate GHG emissions estimates in terms of CO_2 equivalent. No Party reported HFC, PFC and SF_6 emissions. Four Parties provided information on the uncertainty of the estimates (see box 1).

29. Reporting on sectors and subsectors was more comprehensive than required by the UNFCCC guidelines (see tables 2, 4 and 5). For example, most Parties reported CH_4 and/or N_2O emissions from *transport, manure management, field burning of agricultural residues* and *waste* as required by the IPCC Guidelines, although this is not required by the UNFCCC guidelines.

30. Many Parties submitted the worksheets according to the IPCC Guidelines. These worksheets provide information for replicating the inventories of Parties using default methods

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[3] Completeness in this document is understood as a measure of the extent to which an inventory covers all sources and sinks, as well as all gases, included in the Revised 1996 IPCC Guidelines. With the exception of HFCs, PFCs and SF_6, most of the reporting Parties covered the main GHG and IPCC sectors and source categories.

and, therefore, contribute to the transparency[4] of the inventories.[5] Half of the reporting Parties provided worksheets and seven Parties provided CO_2 fuel combustion estimates obtained using both the IPCC reference and the sectoral approach, according to the IPCC Guidelines (see table 6).

31. The two factors that appear to affect the calibre of GHG inventories the most are:

(a) The availability and quality of activity data; and

(b) The preparation of inventories on a continuous basis by stable national teams.

In cases when inventories were updated, the completeness, transparency and quality improved in the new versions (see table 11). This suggests that there is a clear benefit from preparing inventories on a continuous basis. The ability of Parties to improve and update their inventories appears to be a function of the available financial and technical assistance. All Parties, except the Republic of Korea, received external support in preparing their GHG inventories.

32. Most Parties reported on problems encountered when preparing their national inventories, mainly related to the quality or availability of activity data. In some cases, they reported that the methods used to estimate GHG inventories were inadequate and that default emission factors were not appropriate for their national circumstances (see table 8). The effect of these problems on the quality of the inventories is not clear. In addition to reporting on problems, Parties identified what is needed to improve their inventories; in particular, they mentioned the need for financial and technical assistance.

33. Parties made efforts to improve their inventories and to overcome problems. Some Parties described the application of national procedures similar in nature to *good practices*[6] in developing GHG inventories (see table 10).

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[4] Transparency in this document is understood as a measure of the extent to which the assumptions and methodologies used for an inventory are clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The provision of worksheets by some Parties enhanced the transparency of the inventories. IPCC worksheets provide basically the same inventory information as is included in the common reporting format which will be used by Annex I Parties from the year 2000 onwards (FCCC/SBSTA/1999/6/Add.1).

[5] It should be noted that many Annex I Parties used more complex national methods, which generally improves the quality of their inventories, but when they are not well documented in their communication, the information is less transparent.

[6] The IPCC is currently developing guidance on *good practices*. This guidance may be available for consideration by the SBSTA in 2000. Guidance on *good practices* may include, *inter alia*, advice on the choice of methodology, emission factors, activity data, and uncertainties, and on a series of quality assessment and quality control procedures which may be applied during the preparation of inventories.

B. Methodological issues

34. The reporting of inventory data by Parties should follow the UNFCCC guidelines and SBSTA conclusions presented in table1. In almost all cases, Parties demonstrated consistency when following this guidance.

Methods and gases

35. All Parties followed the IPCC Guidelines to estimate their national GHG inventory, and four of them used the Revised 1996 IPCC Guidelines[7] (see box 1). Generally, Parties used IPCC default methods, but some of them developed their own methodologies and emission factors for specific sectors. All Parties presented emission estimates of the three main greenhouse gases CO_2, CH_4 and N_2O on a gas-by-gas basis. All Parties addressed the ozone precursors (CO, NO_x and NMVOC) and provided CO_2 *land-use change and forestry* estimates which encompass removals. Although not required by the UNFCCC guidelines, estimates of aggregate GHG emissions in terms of CO_2 equivalent using IPCC GWP values were provided by six Parties. The following box summarizes the reporting of inventory data by Parties.

Box 1. Status of reporting of inventory data

Party	Method used	Years	Reporting table[a]	Precursors: CO, NO_x, NMVOC	HFCs, PFCs, SF_6	SO_2	Bunkers	CO_2 equivalent estimates
Argentina	IPCC	1990, 1994	IPCC Summary	X	-	-	-	-
Armenia	IPCC	1990	IPCC Summary	X	-	-	X	X
Jordan	IPCC	1994	Table II (*+ waste*)	X	-	-	X	-
Kazakhstan	IPCC	1990, 1994	IPCC Summary	X	-	-	-	X
Mauritius	IPCC,1996	1995	IPCC Summary	X	-	X	X	-
Mexico	IPCC	1990	IPCC Summary	X	-	-	-	-
Republic of Korea	IPCC	1990	IPCC Summary	X	-	-	X	X
Senegal	IPCC, 1996	1994	Table II (*+ waste*)	CO, NO_x only	-	-	-	X
Uruguay	IPCC, 1996	1990, 1994	IPCC Summary	X	-	X	X	X
Zimbabwe	IPCC, 1996	1994	IPCC Summary	CO, NO_x only	-	-	-	X

[a] "Table II" refers to table II of the UNFCCC guidelines for the reporting of inventory data.

[7] It should be noted that these guidelines were available only as from mid-1997.

36. The degree of completeness in reporting on sectors and subsectors is high (see table 2). All Parties reported the most significant GHG emission source and sink categories, such as CO_2 emissions or removals from *fuel combustion*, *industrial processes* and *land-use change and forestry*, CH_4 emissions from *agriculture* and *waste*, and N_2O from *fuel combustion*.

37. Fully fluorinated compounds,[8] the reporting of which is encouraged by the UNFCCC guidelines, were not reported by the Parties. Thus there was no reporting of PFC and SF_6 emissions. Also, no Party reported emissions of HFCs. The SBSTA,[9] at its fourth session, encouraged Parties to report actual emission estimates of these three types of greenhouse gases. Methodologies to estimate emissions of these gases were included in the Revised 1996 IPCC Guidelines for the first time.

38. Estimates of emissions from *international aviation and marine bunker fuels* were reported by five Parties. In conformity with the guidelines, these emissions were reported separately from national totals, and four Parties provided a breakdown into marine and aviation bunkers. One Party (Argentina) provided data on the amount of fuel sold to the market.

39. The UNFCCC guidelines request Parties to make efforts to report the estimated range of uncertainty of their emission estimates, where appropriate. The reporting of uncertainties was limited. Four Parties complied with this request, two of them providing the information quantitatively, and the other two Parties qualitatively. For estimates from the *energy* sector high confidence levels were reported, while for the *land-use change and forestry* sector confidence levels were considered to be medium[10] (see table 3).

Reporting tables

40. All Parties reported their inventories consistently with the UNFCCC guidelines, presenting even more information than the minimum requested and using more comprehensive tabular formats than table II of those guidelines. As all Parties followed the IPCC Guidelines for estimating their GHG emissions, they also, generally, used the reporting formats of these guidelines: eight of the ten reporting Parties used the IPCC summary table, and the other two Parties presented their inventories using table II of the UNFCCC guidelines, but included other sectors or source categories which are not explicitly required by that table.

41. The use of the IPCC summary tables provides for a more thorough reporting of inventory data than the use of table II of the annex to the UNFCCC guidelines. Several individual GHG

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[8] A fully fluorinated compound is one which contains atoms of fluorine (F) and only one other element (e.g. C, S, N). Thus, perfluorocarbons (PFCs), such as CF_4 and C_2F_6, and sulphur hexafluoride (SF_6) are fully fluorinated compounds, while hydrofluorocarbons (HFCs) are not.

[9] FCCC/SBSTA/1996/20, paragraph 31.

[10] For confidence levels reported by Annex I Parties, see document FCCC/SBSTA/1998/7, table 14.

emissions from different IPCC source categories are not explicitly requested by table II of the UNFCCC guidelines, which is particularly the case for some significant source categories, such as *waste*, *agricultural soils* and *manure management*. However, all reporting Parties provided emission estimates for many of those source categories (see table 4).

42. The share of emissions from these unrequested source categories in a Party's total reported GHG emissions could be substantial. If Parties had reported only the source categories explicitly requested by table II of the UNFCCC guidelines, significant shares of Parties' aggregate GHG emissions would not have been reported (see table 5).

43. Although not requested by the UNFCCC guidelines, half of the reporting Parties also provided IPCC worksheets (see table 6), which provide detailed calculations for the estimation of GHG emissions as well as numerical information on aggregate emission factors and activity data for inventories using IPCC default methods. The provision of these worksheets contributes substantially to the transparency of the inventories.

44. In addition, seven Parties estimated their fuel combustion emissions using both the reference and the sectoral approach, as requested by the IPCC Guidelines (see table 6). This is a useful self-verification procedure which greatly improves the transparency of the inventories. However, the usefulness of applying both approaches would be enhanced if the identified differences were explained by Parties. For most Parties, the range of difference between the results obtained with the two approaches was of similar magnitude to the differences reported by Annex I Parties which made this comparison.[11]

45. Table II of the UNFCCC guidelines requests Parties to describe assumptions and methods, and the values of emission coefficients, where these differ from IPCC default methods and coefficients. This request allows for a more transparent reporting of inventory information by Parties. For most of the sectors, Parties used the default emission factors provided in the IPCC Guidelines (see table 7). However, Parties made efforts to develop their national emission factors in order to better reflect their national circumstances, such as for *rice cultivation*, as reported by the Republic of Korea (see table 10).

46. The source of the activity data used for the emission estimates of the different sectors and source categories was referenced by almost all Parties, even though this information is not explicitly requested by the UNFCCC guidelines. Generally, Parties indicated that activity data were obtained from national sources, such as national statistics provided by the respective ministries, municipalities and agencies, or from industrial facilities. In some cases, reference to international statistics was made, for example to statistics of the Food and Agriculture Organization of the United Nations (FAO) by Senegal and Uruguay.

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[11] See document FCCC/SBSTA/1998/7, table 3.

Methodological problems identified by Parties

47. Eight Parties explicitly identified problems in preparing their national inventories (see table 8). Most of the problems relate to the lack of activity data for estimation of emissions in some sectors or unavailability of activity data that suit the needs for reporting in line with the IPCC Guidelines. Three Parties (Armenia, Uruguay, Zimbabwe) reported problems related to the lack or limitations of the current IPCC methodology for estimation of emissions in some sectors. Two Parties (Republic of Korea, Uruguay) explicitly stated that, for some source categories, the use of IPCC default emission factors was not appropriate for their national circumstances and that the lack of national emission factors in these cases could affect the accuracy of the estimates.

Methodological issues identified during the compilation and synthesis

48. In addition to the difficulties mentioned by Parties, other issues were also identified during the process of compiling the inventory information of the initial national communications:

(a) In some cases, there were inconsistencies in the inventory data provided, for example:

(i) Different values of emission estimates for the same sectors or source categories in tables at different places in the communication;
(ii) Totals given for a certain sector did not represent the sum of the values of each of the subsectors reported;
(iii) When reporting CO_2 emissions and removals from *land-use change and forestry*, the signs, "+" or "-", indicating removals or emissions, were sometimes used indistinctly;

(b) Most Parties slightly changed the format of the IPCC summary tables or did not include the precursors. In some cases, it was not clear whether certain source categories were not reported because they were not relevant for the country or had not been estimated for other reasons;

(c) In the *land-use change and forestry* sector, some inconsistencies were found in the reporting of estimates of biomass during a deforestation process, namely the fractions of biomass burned on site, burned off site and left to decay. In addition, there was no clear indication as to the time-frame of the activity data used in some source categories, such as *forest and grassland conversion* and *abandonment of managed lands*.

A useful tool to overcome some of these difficulties could be the IPCC software,[12] which facilitates the accurate reporting of inventory data.

Methodological problems encountered in the use of UNFCCC guidelines

49. Parties provided the best available data in their national GHG inventories, a task which was facilitated by the existence of the IPCC and UNFCCC guidelines. However, some common problems with the use of these latter guidelines[13] were identified:

(a) The minimum information requirements of table II of the annex to the UNFCCC guidelines do not allow for complete reporting of GHG emissions by sources and removals by sinks;

(b) The UNFCCC guidelines do not explicitly encourage Parties to apply the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, as appropriate and to the extent possible, as urged in relevant SBSTA conclusions adopted after adoption of decision 10/CP.2 (see table 1);

(c) The UNFCCC guidelines encourage Parties to include in their national inventories information on fully fluorinated compounds, which cover, *inter alia*, PFC and SF_6 emissions. The reporting of HFC emissions is not covered by this encouragement. In addition, there is no specification as to the reporting of actual or potential emissions of these substances. However, conclusions adopted by the SBSTA at its fourth session, encourage Parties to report explicitly actual emissions of HFCs, PFCs and SF_6 (FCCC/SBSTA/1996/20, paragraph 31).

C. Issues related to the preparation of inventories

Institutional arrangements

50. A description of the existing institutional arrangements relevant to the preparation of national inventories on a continuing basis[14] was provided by seven Parties.[15] In most cases, these arrangements consist of inter-institutional committees or agencies, or teams of national experts from different sectors, both from the public and from the private sector, coordinated by a leading national institution or ministry. Argentina mentioned the significant contribution of a non-governmental organization to the preparation of its national inventory.

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[12] Greenhouse Gas Inventory Software for the Workbook - Instrumentation Manual 1996.

[13] See decision 12/CP.4, paragraph 7(b).

[14] See decision 10/CP.2. annex, paragraph 4.

[15] Argentina, Kazakhstan, Mauritius, Mexico, Republic of Korea, Uruguay, Zimbabwe.

Improvements, needs and support received

51. Almost all Parties identified areas for further improvement of inventory data, which mainly address problems identified above (see table 9). Argentina, Jordan, Kazakhstan, Mexico, Uruguay and Zimbabwe mentioned the need for financial and technical assistance to improve their inventories. In addition, Parties draw attention to the importance of continuous collection of data and/or the establishment of databases appropriate to the requirements of IPCC reporting.

52. In addition to the identification of areas for further improvement of inventory data, Parties made their own efforts to improve the quality of their emission estimates. Some Parties described the application of some elements, which might be related to *good practices*, while preparing their national inventory. For example, some of them compared estimates obtained using the IPCC methodology or default emission factors with estimates obtained using their own methods, models and/or national or regional emission factors. It should be noted that the guidance on *good practices* under development by the IPCC may be relevant to the preparation of inventories by Parties, and may help solve the problems related to, *inter alia*, emission factors and activity data in a comprehensive way (see table 10).

53. Improvements in the completeness, transparency and quality of the inventories were recognized in the inventories of Parties which updated their previously submitted inventory data (see table 11). In some cases, problems identified by a given Party in its initial inventory were overcome in the later inventory. This suggests that by preparing the GHG inventories on a continuing basis, the reporting and quality of inventory data can be improved and some of the difficulties overcome.

54. The technical and financial support received by reporting non-Annex I Parties constituted a key element in the preparation of the national inventories. All Parties, except the Republic of Korea, which is a donor to the Global Environment Facility (GEF), and Kazakhstan received support from the GEF and its implementing agencies for the development of enabling activities, which included the preparation of their national inventories in the context of their national communications.[16] It should be noted that most reporting Parties also received in addition technical and financial assistance for preparing inventories through bilateral or multilateral channels, mainly from the United States Country Study Program.[17] This fact also underlines the close relationship that exists among the quality of the inventories, their preparation on a continuing basis and the need for adequate resources and financial and technical support to prepare them.

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[16] Parties may wish to refer to document FCCC/SBI/1999/INF.7 which provides information on activities to facilitate the provision of technical and financial support for the preparation of national communications for non-Annex I Parties, and to document FCCC/SBI/1999/INF.8 on information on relevant actions by the GEF.

[17] Parties also received assistance from the Netherlands Climate Change Studies Assistance Programme, the Canadian Government, the CC: TRAIN of the United Nations Institute for Training and Research (UNITAR) and from the National Communications Support Program/GEF/UNDP/UNEP.

D. Presentation of results

55. Tables A.1 to A.8 in the annex to this document summarize inventory data for CO_2, CH_4, N_2O, ozone precursors and international bunkers. The analysis provided in this section[18] is based on 1994 inventory data where possible. In some instances, estimates have been converted into CO_2 equivalent estimates using 1995 IPCC global warming potentials, in order to facilitate comparison of inventory results. Such a presentation shows, for example, the relative contribution of the different greenhouse gases and the different sectors to a Party's total greenhouse gas emissions.[19]

Emissions by sources and removals by sinks

56. The reporting Parties represent a net source of GHG emissions, with the exception of Zimbabwe, which is a net GHG sink, due to the large CO_2 removals reported in the *land-use change and forestry* sector. Looking at CO_2 only, Senegal also shows a net uptake of CO_2, as removals from *land-use change and forestry* exceed total CO_2 emissions.[20]

Aggregate GHG emissions expressed in terms of CO_2 equivalent[21]

57. CO_2 was the most important GHG for all Parties except Uruguay, for which CH_4 was the most important. CH_4 was the second largest contributor to aggregate GHG emissions for seven Parties, while N_2O represented less than 2 per cent for another seven Parties.[22] However, the relative importance of the individual GHGs did not display the same pattern for all Parties; for

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[18] The Federated States of Micronesia are not included in the analysis of this section, as the national communication did not include a GHG emission inventory. The national communication stated that the country's GHG emissions represent a negligible percentage of the world's total GHG release, and that it can be assumed that because of the sink capacity of its extensive forests and coral reef systems, the country may provide a net uptake of GHGs.

[19] It should be noted that six out of the ten Parties considered here used CO_2 equivalent estimates to assess the relative contribution of each individual greenhouse gas or sector to their aggregate GHG emissions.

[20] In view of the different role of the *land-use change and forestry* sector in the different Parties - in some, this sector offsets total emissions, while in others it is a large source of emissions - and the request by the IPCC Guidelines to provide net emissions or removals in the different source categories of this sector, the term "total CO_2 emissions" in this document denotes the sum of CO_2 emissions from all sectors except CO_2 emissions and removals from *land-use change and forestry*. This facilitates the presentation of the data in a consistent and comparable manner. Nevertheless, the magnitude of CO_2 *land-use change and forestry* emissions and removals is shown in relation to Parties' total CO_2 and aggregate GHG emissions.

[21] Aggregate GHG emission estimates given in this document represent the sum of total CO_2, CH_4 and N_2O emissions expressed in CO_2 equivalent, using IPCC 1995 GWP values. Total CO_2 emissions are calculated in line with the definition given in footnote 20.

[22] It should be noted that in some cases N_2O emissions from *agricultural soils* were not reported by Parties.

example, in Uruguay CO_2 had the smallest share of aggregate GHG emissions (14 per cent). The relative importance of CO_2 removals from *land-use change and forestry* is also shown in figure 1.

58. *Energy*, *agriculture* and *land-use change and forestry* constituted the largest sources of GHG emissions for the reporting Parties. Removals by sinks from *land-use change and forestry* were also large, offsetting emissions from this sector for all reporting Parties except Mexico. The *energy* sector as a whole was the largest source of GHG emissions for most Parties, while *agriculture* was the most important source for Uruguay. In Mexico, *land-use change and forestry* constituted the second largest source of GHG emissions (see figure 2 and table A.1).

59. At the subsector and source category level, *stationary fossil fuel combustion* was the single largest source of aggregate GHG emissions for most Parties, shares ranging up to 75 per cent of Parties' aggregate GHG emissions. In Senegal and Uruguay, livestock emissions had the highest proportion, accounting for 29 and 46 per cent, respectively. *Transport* was the second largest source of emissions for three Parties (Armenia, Mauritius, Republic of Korea) and represented a share of 20 to 25 per cent for Argentina and Mexico. When comparing the relative importance of emissions from the *forest and grassland conversion* subsector with aggregate GHG emissions, the subsector was twice as big as the aggregate GHG emissions for Senegal, while in Argentina, Mexico and Zimbabwe these emissions were equivalent to 20, 42 and 9 per cent of aggregate GHG emissions, respectively.

Emissions of main greenhouse gases (CO_2, CH_4 and N_2O)

60. *Fuel combustion* in the *energy* sector was found to be the largest source of total CO_2 emissions for all Parties, ranging from 86 (Zimbabwe) to 100 (Mauritius) per cent of total CO_2 emissions. The *land-use change and forestry* sector as a whole constituted a net sink for all Parties but Mexico, where the emissions from *forest and grassland conversion* exceeded the total removal. This subsector was also a significant source of CO_2 emissions for Argentina, Jordan and Senegal, which offset the Parties' total sink capacity by 35 to 75 per cent (see figure 3). *Energy industries* were the largest source within the *fuel combustion* sector for six Parties (37 to 53 per cent). *Transport* was the most important source for Argentina and Uruguay (32 to 55 per cent) and accounted for more than 30 per cent of *fuel combustion* CO_2 emissions for Mexico, Mauritius and Senegal (see table A.3). CO_2 emissions from international bunker fuels were reported by five Parties and were equivalent to between 39 (Mauritius) and 2 per cent (Armenia) of total CO_2 emissions.[23]

61. *Agriculture* was the most significant source of CH_4 emissions for six of the reporting Parties (92 to 44 per cent). *Fugitive fuel* emissions were the most important CH_4 source for Armenia and Kazakhstan (52 and 44 per cent), and *waste* for Jordan and Mauritius (93 and

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[23] According to the UNFCCC and IPCC Guidelines these emissions are not accounted for in national GHG emissions.

74 per cent) (see table A.5). In the agricultural sector, livestock was the most important subsector for all reporting Parties, except for the Republic of Korea, where *rice cultivation* was the most significant. *Agriculture* was found to be the most important source of N_2O emissions for half of the reporting Parties, ranging from 99 (Uruguay) to 49 (Argentina) per cent, while combustion of fossil fuels at stationary sources was the largest source for Jordan, Kazakhstan and the Republic of Korea (70 to 80 per cent). For Zimbabwe, *industrial processes* constituted the most important N_2O source, while for Senegal it was the burning of cleared forests in the *land-use change and forestry* sector (see annex, table A.6).

E. Current trends

62. In addition to the inventory data for the year 1994 or 1990 requested by the UNFCCC guidelines, three Parties, Argentina, Kazakhstan and Uruguay, provided a complete GHG emission inventory for both 1990 and 1994, allowing for a preliminary analysis of the trends of GHG emissions in these countries. Additionally, 1990 and 1994 emission estimates from the *energy* sector were also presented by Armenia, the Republic of Korea and Zimbabwe.

63. Total CO_2 emissions (excluding *land-use change and forestry*) increased over the 1990 to 1994 period for Argentina and Uruguay (13 and 10 per cent), while for Kazakhstan total CO_2 emissions declined (22 per cent). Trends in CO_2 emissions differed if the *land-use change and forestry* sector was included in total CO_2 emissions: the increase in total CO_2 emissions was then significantly higher in Argentina (34 per cent), while in Uruguay a 42 per cent decrease could be noted, due to the developments in this sector[24] (see figure 4).

64. CO_2 emissions from *fuel combustion* increased in 1994 compared to 1990 for three Parties (Argentina, the Republic of Korea and Uruguay), while another three Parties (Armenia, Kazakhstan and Zimbabwe) reported a decline. The largest increase was reported by the Republic of Korea (43 per cent), while the sharpest decline was reported by Armenia (86 per cent).

65. Total CH_4 emissions rose from 1990 to 1994 for three Parties (13, 2 and 11 per cent for Argentina, Kazakhstan and Uruguay, respectively). Total N_2O emissions increased in Argentina and Uruguay compared to 1990 levels (58 and 3 per cent) and sharply decreased in Kazakhstan (94 per cent).

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[24] For Uruguay, the *land-use change and forestry* sector was a net CO_2 emitter in 1990, while in 1994 it was a net sink. The Party explained that this change in the pattern of net emissions from this sector was a consequence of an implemented policy.

IV. NATIONAL CIRCUMSTANCES AND DEVELOPMENT PRIORITIES

66. In accordance with the UNFCCC guidelines, Parties included a section on national circumstances in their communications, with differing levels of detail. Parties stressed that geographical location was a determining factor in their vulnerability to the effects of climate change, which include changes in agricultural patterns, water resources, vegetation and forest cover. In general, agriculture was considered to be the main development priority, even though service sectors contributed 50 per cent or more to GDP, and industrial sectors around 30 per cent. Agriculture plays a major role in these Parties' policies for poverty alleviation.

67. Seven Parties incorporated the national circumstances table as requested in the guidelines, some with slight additions. The remaining four communications also provided this information, but in different tables under the relevant sections or elsewhere in the text. The data provided suggest that for most Parties, the percentage of the population living in absolute poverty remains high (see table 12).

68. All Parties emphasized **agriculture** as a development priority, even though agriculture's share of GDP ranged from 0.4 per cent for the Federated States of Micronesia to 40 per cent for Armenia. Similarly, the share of agricultural area as a percentage of total land area varied widely, ranging from 0.6 per cent for Jordan to 81.6 per cent for Kazakhstan (including grasslands). Statistics relevant to agricultural production incorporated data on main crop groups or individual crops (mainly grains), or categories of agricultural land use.

69. Information provided on **livestock production** indicates that the rate and direction of change of livestock populations varied widely among the different Parties, depending on their national circumstances. Data provided by Argentina indicated a decreasing population of cattle, sheep and goats, while the Republic of Korea reported an increasing trend for the population of cattle, chicken and pigs, as well as an expectation of further growth in the future, mostly due to a shift in the Korean diet. Senegal singled out poultry production as contributing over 7 per cent to its GDP. Sheep breeding is important in Kazakhstan and meat and wool production in Uruguay.

70. **Fisheries** were mentioned as being one of the main economic sectors by some Parties, which indicated that their fish stocks are already under threat owing to pollution and overexploitation.

71. Detailed information was provided on the **energy** sector, particularly regarding energy production and consumption, energy reserves, energy-sector management and institutions. Most Parties projected a significant growth in their future energy supply and demand, with annual growth rates ranging from 4 to 7 per cent for the period till the year 2010.

72. Parties reported a general trend of recent and expected increases in road **transport**, and identified outdated vehicle fleets as a problem. Argentina mentioned lack of data as an impediment to assessment of the evolution of the sector.

73. Parties provided information on their **forest resources**, including data on forest areas and species. Some provided information on forest densities and management practices. Argentina mentioned the lack of conclusive data. Mexico and the Federated States of Micronesia mentioned deforestation as an issue of concern.

74. In addition to the above-mentioned priority areas, **other sectors** were also identified by some communications, including marine resources, such as coral reefs, and flora and fauna, and mining, tourism, international financial services, and cultural and historical resources. Tourism was identified as a sector that would continue to grow.

V. SUSTAINABLE DEVELOPMENT AND THE INTEGRATION OF CLIMATE CHANGE CONCERNS INTO MEDIUM- AND LONG-TERM PLANNING

75. In accordance with the UNFCCC guidelines, Parties provided information on cross-cutting issues related to sustainable development, and integrating climate change concerns into medium- and long-term planning. The description appeared under different sections of the communications in varying levels of detail; Parties did not have a specific section on programmes or activities related to sustainable development. Several Parties provided information on building capacity to integrate climate change concerns in medium- and long-term planning.

76. Parties provided information on existing or planned **sustainable development** activities as part of national development or environmental plans, institutional arrangements (such as national committees for sustainable development or governmental institutions dedicated to the implementation of environmental and development priorities) and national legislation on environment and/or development. Mexico, Senegal and Zimbabwe described in detail activities with relevance to sustainable development following the 1992 United Nations Conference on Environment and Development in accordance with the priorities for implementing Agenda 21.

77. In describing sustainable development concerns under their environment or development plans, Parties emphasized the need for ensuring an integrated approach between environmental issues (Federated States of Micronesia, Kazakhstan and Senegal), coordinating national environment and development policies (Federated States of Micronesia) and prioritizing areas where measures should be concentrated (Jordan).

78. Parties also described activities that these plans should include, namely the protection of natural resources, including assessing environmental impacts and conserving soil, water resources, forests and biodiversity; improvement of waste management, pollution control and land-use planning; integration of economic incentives and tools into environmental policies; and enhancement of public awareness and the participation of non-governmental organizations and the private sector in the implementation of measures.

79. Argentina, Armenia, Jordan, Kazakhstan, Mauritius, Mexico and Zimbabwe drew attention to the fact that climate change and its adverse impacts would be taken into account in relevant future social, economic and environmental actions in accordance with national sustainable development priorities. Some Parties mentioned the need for financial resources for implementing activities envisaged in their sustainable development frameworks, such as for the management of natural resources (Senegal), and the conservation of biodiversity (Federated States of Micronesia).

80. Parties are **integrating climate change concerns into medium- and long-term planning** by establishing institutional arrangements to deal with climate-change related concerns in the short, medium- and long-term. For example, Zimbabwe has established a National Steering Committee on Climate Change and a Climate Change Office with a full-time coordinator and secretary, which forms the institutional core of climate change activities. Zimbabwe also reported a regional climate change capacity-building programme funded by GEF through the UNDP. This programme seeks to improve national capacity to analyse impacts and response options to climate change in various economic sectors. Kazakhstan has established a governmental committee responsible for implementing the UNFCCC, and a new inter-agency commission was organized to fulfil the Party's obligations under the Convention. Argentina and Uruguay have established climate change units within their ministries of the environment to implement the Convention. Mexico has amended its clean air legislation, in an attempt to regulate carbon dioxide emissions. The Republic of Korea has established a national committee for energy conservation.

81. Armenia and Kazakhstan indicated that they are in the process of formulating a comprehensive **national action plan** (NAP) or strategy on climate, and noted the importance of developing a NAP. Other Parties mentioned related plans, for example on nature conservation (Zimbabwe), on energy conservation (Republic of Korea), or generally on the environment (Jordan).

82. Commonly, the national climate policy is administered by a ministry, often the ministry closest to matters of the environment and energy. Some Parties (Federated States of Micronesia, Mexico) reported that there is a lack of a clear division of labour or a clear mandate for a single **institution** to work on climate change. Others (Argentina, Republic of Korea, Zimbabwe) have designated committees or commissions to consider steps relating to addressing climate change and its adverse effects. Argentina and Zimbabwe have created climate change units. Zimbabwe is actively involving non-governmental organizations in the development of its climate policy, and has included measures to address climate change and its adverse impacts as part of the national conservation strategy.

83. Parties also reported on national environmental or energy-saving **laws**. Environmental legislation is in place in three countries (Argentina, Mauritius, Mexico), and under debate in Zimbabwe. In addition, energy conservation legislation or strategies are in force in two countries (Jordan, Republic of Korea), and are subject to review in two more countries (Kazakhstan,

Senegal). Some Parties reported that a forestry law is in place (Mauritius, Mexico, Uruguay); Jordan, Mauritius and the Republic of Korea mentioned strategies or legislation to foster the use of renewable energy sources.

84. Parties identified **criteria** for the measures being considered. Armenia, the Federated States of Micronesia, Kazakhstan and Zimbabwe stated that measures should be in line with their **long-term policy goals** and existing programmes such as coral reef protection (Federated States of Micronesia), combating desertification (Armenia), energy security (Armenia, Kazakhstan, Republic of Korea), and economic development (Armenia, Kazakhstan). Kazakhstan and Zimbabwe suggested that cost-effectiveness would be a good criterion for identifying options to address climate change.

VI. NEEDS AND CONCERNS ARISING FROM ADVERSE EFFECTS OF CLIMATE CHANGE

85. All Parties reported vulnerability to the effects of climate change in at least one area. Some communications indicated that standard global circulation models were used to build climate change scenarios for their countries, while other Parties used expert assessments for this purpose. Some scenarios provided for an increase in precipitation and others for a decrease in precipitation for the same country. Only some Parties mentioned the impact of **natural disasters** - hurricanes, floods and drought. All Parties elaborated on the need for further research to study their vulnerability comprehensively.

86. Each of the Parties reported the vulnerability of their **agricultural sector** to the impacts of climate change, which could result in temperature shifts and changes in the duration of crop cycles, alterations of soil characteristics, changes in water availability, and/or changes in the prevalence of pests and diseases.

87. Several impacts of climate change on agricultural soil were identified. Armenia noted a reduction of soil humidity of up to 30 per cent and expects arid areas to expand by 33 per cent. Kazakhstan mentioned an expectation of soil degradation and decrease of up to 27 per cent in wheat production. Mauritius mentioned that an increase in saline drift from sea spray would result in land degradation, slower nutrient recycling and a change in the flora and fauna of soil.

88. Some crops would be negatively affected by climate change, such as barley (Uruguay), corn and maize (Argentina, Mexico, Zimbabwe), flowers (Mauritius), fruits (Armenia, Mauritius Republic of Korea), millet (Senegal), sugar cane (Mauritius), vegetables (Armenia, Mauritius), and wheat (Argentina, Republic of Korea, Uruguay).

89. The Federated States of Micronesia, and Mauritius, mentioned that the most vulnerable **coastal areas** are also the most valuable, whether for recreation and tourism (Mauritius), or for being the most heavily developed, with homes, infrastructure, historical and cultural sites, and

for providing economic opportunities for the majority of the population (Federated States of Micronesia).

90. Almost half of the communications provided information on the impact of climate change on their **forest ecosystems**, and mentioned an increase in aridity. Mexico mentioned an expected loss of 10 per cent of forest vegetation, while Armenia reported an anticipated 15 per cent decrease in annual growth of woody biomass. Mauritius reported that extreme climatic events would render forest regeneration more difficult and result in changes that would alter biodiversity in the long term. The Republic of Korea reported that the decline of its forests would begin 30 years after a change in climate, while severe damage would occur after 100 years.

91. Parties reported information on the vulnerability of **human health** within their countries to changes in climatic conditions. All of these mentioned specific diseases that would increase in incidence, such as malaria (Argentina, Mauritius, Zimbabwe), cholera (Armenia, Zimbabwe), and dengue fever (Argentina, Zimbabwe). Parties also noted that there could be an increase in cardiovascular and intestinal diseases (Armenia); influenza (Mauritius); yellow fever and general morbidity (Zimbabwe). Armenia and Mauritius emphasized that certain segments of the population would be more vulnerable than others.

92. Parties reported an expected reduction in **livestock production**, as a result either of a reduction in pasture areas, or of a reduction in the productivity of existing pasture areas. Kazakhstan expects a lower nitrogen content of fodder to lower protein levels, which would in turn diminish the nutritional value for livestock. Armenia expects a 30 per cent reduction in the number of cattle.

93. **Fish production** is vulnerable to climate change. Mauritius expects a change in the size and location of fish populations and their migratory behaviour. The Republic of Korea expects the extinction of cold-water fish in the Yellow Sea due to a rise in sea-water temperature. The effect on deep-water fish is dependent on whether temperature would change at great depths, which is still uncertain.

94. Parties expect an adverse effect on their **water resources**, including an increase in evaporation levels, water shortages and droughts. Kazakhstan expects a 20 to 30 per cent reduction in water resources. Argentina expects a reduction in irrigation water availability and Zimbabwe anticipates an increase in demand for irrigation water due to increased levels of evapotranspiration necessitating the construction of new dams. Armenia expects a reduction of annual river flow by 15 per cent. On the other hand, Argentina, the Federated States of Micronesia and the Republic of Korea expect that an increase in rainfall could increase the risk of floods. Some Parties mentioned that hydroelectric power generation would be affected by changes in fluvial flows. Jordan emphasized the need to conduct a study on the areas of potential

vulnerability of water resources in the country, and the potential impacts of climate change on this sector. Some Parties reported an expected intensification of desertification and an increase in hyper-arid, arid or semi-arid areas.

VII. ADAPTATION MEASURES AND RESPONSE STRATEGIES

95. All Parties reported on adaption measures and stated their intention to implement adaptation measures to counter future climate change. The level of detail of the steps varied considerably across Parties. In general, Parties' reporting reflects a fair understanding of their vulnerability, but is less specific in assessing adaptation needs. The descriptions of the issues addressed and level of detail reflect the different nature of vulnerability in the respective countries. The choice of institutional framework is strongly linked to the national circumstances, such as the country's geography, the state of its environment and population density. The adaptation measures that were reported have not yet been implemented, and descriptions of their effectiveness in aggregate were not provided. Few Parties attempted to cost and measure the effectiveness of individual adaptation measures. Most Parties emphasize that adaptation measures should incorporate a strong research component in order to study the Parties' vulnerability comprehensively and develop response options.

96. Parties emphasized that research is needed to develop response options. Examples of research needs are improvement of groundwater storage (Zimbabwe), and more drought-tolerant and disease-resistant crops and livestock (Armenia, Mauritius, Zimbabwe). Some of the measures proposed, such as protection of forests, reforestation, and conservation of coral reefs, are reported to exhibit both adaptation and mitigating effects (Federated States of Micronesia). Jordan and Kazakhstan provided a detailed costing of potential adaptation measures. No Party has undertaken an integrated vulnerability assessment, and as a result potential synergies or negative side-effects have yet to be determined.

97. Among the barriers to implementation, Parties mentioned technological constraints (Jordan) and financial barriers to capital-intensive measures such as coastal zone management (Uruguay). Some Parties (for example, Zimbabwe) mentioned the need to consider the conditions of and provide education to the poorer and most vulnerable segments of the population.

A. Agriculture

98. The Parties reported that adaptation in the agricultural sector is particularly important in order to protect the food base. In addition, a majority of the population still earn a large share of their income from the agricultural sector. Parties thus focused on measures to protect the most common staple foods depending on national circumstances.

99. Parties reported measures relating to the introduction of new and more resistant crops, changed use of fertilizers and herbicides, different irrigation methods, special soil treatment, and other altered agricultural practices. Zimbabwe mentioned that the switch to livestock production, and from monoculture to diversified agriculture, could be beneficial. Kazakhstan mentioned the need to maintain regional centres which stock genetic material.

100. Among the methods to improve irrigation, one Party mentioned drip irrigation, evening and night watering, and frequent light watering (Armenia). In order to maintain and regain soil quality, Parties suggested increasing soil shading, lowering the soil temperature, and lowering evaporation from the ground surface (Armenia, Uruguay). The Federated States of Micronesia stressed that some intensive agricultural practices such as use of inorganic and chemical pesticides should be discouraged and traditional composting techniques encouraged. Mauritius mentioned putting limitations on the use of water for crop irrigation.

B. Water resources

101. Over half of the reporting Parties discussed adaptation and water resources. The detailed description of water resources by all of the Parties reflects their emphasis on water management as a key area for adaptation steps to be taken in the future.

102. Parties mentioned perceived changes in water availability, and the need for redistribution of available supplies between agricultural and industrial uses, as adaptation options. Parties also mentioned the need to improve and monitor water quality.

103. In relation to water infrastructure, Parties identified the drilling of wells to access deep groundwater as an option. Pumping of water could be undertaken with the help of solar technology (Federated States of Micronesia, Zimbabwe). In addition, water storage reservoirs and dams are being built and extended (Kazakhstan, Zimbabwe), or are planned (Armenia). Other activities include the restructuring and construction of water infrastructure and reduction of leakage (Federated States of Micronesia, Jordan), the construction of solar desalination systems to increase the availability of freshwater (Federated States of Micronesia) and the implementation of nature and forest conservation measures (Federated States of Micronesia, Kazakhstan) to stabilize watersheds, and thus water resources.

104. Jordan reported on the need for institutional development relating to water management.

C. Forestry

105. A number of Parties reported adaptation measures in the forestry sector. Forest development and conservation were seen as important to protect watersheds, preserve species and sequester carbon (Federated States of Micronesia). Several Parties referred to the need for protected forest areas. Related activities that were noted included the need for protecting forests under stress (Zimbabwe), the possibility of forest expansion, for example through plantations

(Armenia, Mauritius, Zimbabwe), the need for structures to combat mud torrents (Armenia) and the preservation of genetic funds and reintroduction of endangered species (Armenia).

D. Coastal zone management

106. Coral reef protection is the most significant response option to the adverse effects of climate change reported by the Federated States of Micronesia. Coral reef protection was proposed through the creation of protected areas, emphasizing indigenous and customary practices related to harvesting and fishing, and regulating other fishing and shipping practices. Mauritius proposes to research the costs of various protective methods such as sloping sea-walls and offshore breakwaters. Uruguay has undertaken active protection of coastal areas through the building of retention walls and sand injections to counteract soil erosion; and has evaluated the costs of adaptation measures for various scenarios of sea-level rise, while also estimating the opportunity costs of taking no adaptation measures.

107. Other measures proposed included limiting the development of infrastructure near coastlines, restoring beach vegetation, and waste management.

E. Human health

108. Armenia listed measures to counter increased vulnerability to human health, including raising socio-economic living standards, increasing sanitary and hygienic awareness, and vaccinating and monitoring risk group populations and particularly exposed territories.

VIII. MEASURES CONTRIBUTING TO ADDRESSING CLIMATE CHANGE

109. All of the Parties reported measures that will contribute to addressing climate change by limiting the increase in greenhouse gas emissions and by enhancing sinks. The general level of reporting provides a good picture of the status of steps taken by these Parties. Most Parties indicated the need for further studies on the economic and social costs and benefits of the potential measures.

110. Some Parties have undertaken an analysis of measures identified, through estimating both the costs of measures and the potential or actual greenhouse gas emission reduction. For example, Kazakhstan provided an aggregated estimate of the reduction potential of 158 million tonnes of carbon dioxide between 2000 and 2020 at a cost of about $5 billion, and Zimbabwe estimated the total potential for savings at 72.6 GJ by 2010, and 217.9 GJ by 2030 in terms of primary energy saved per measure. Jordan provided a list of 20 possible projects with detailed cost and emission savings estimates. The terminology and definitions used in such quantification of measures varied among the Parties.

111. The measures that were reported are mainly potential measures or projects. A number of steps are at the **implementation** stage, although their current status remained unclear. Some

Parties (Mauritius, Mexico, Uruguay) have implemented measures in the forestry sector. The Republic of Korea has already implemented a wide range of measures in the energy sector, mostly in the area of energy efficiency, yielding a significant reduction in energy consumption. The Federated States of Micronesia do not see much scope for mitigation policies, although they acknowledge the need to set an example by making a reasonable effort.

112. The most **significant measure** varied considerably, depending on national circumstances. Many Parties ranked energy conservation and energy efficiency measures high, partly due to their potential medium-term cost-savings. Some Parties are also intending to switch away from fuels with higher carbon intensity, such as coal, to natural gas and renewables. Zimbabwe addressed the importance of regional power pooling. Measures related to addressing climate change are generally co-financed or assisted by international organizations and bilateral programmes. The Republic of Korea is planning to assist developing countries in undertaking measures contributing to addressing climate change.

113. Parties did not specifically describe **barriers** to implementation of measures. However, the lack of finance and capital (Kazakhstan, Zimbabwe), and other economic barriers (Zimbabwe), technological constraints (Jordan, Mauritius, Uruguay, Zimbabwe), and lack of cooperation and clear-cut competence among institutions (Federated States of Micronesia) were mentioned in relation to individual measures. For Zimbabwe, financial constraints pose a prohibitive barrier to implementing energy efficiency measures in small-scale industry.

114. The measures implemented are mostly project-based activities. Mexico referred to its experience under the activities implemented jointly (AIJ) pilot phase. A number of Parties are considering implementing standards and other regulatory instruments that will reduce greenhouse gas emissions. These include standards for energy efficiency (Kazakhstan, Mauritius, Republic of Korea, Zimbabwe), and bans on products and activities (Federated States of Micronesia, Mauritius). In terms of economic instruments some Parties are considering taxes and subsidies (Jordan, Federated States of Micronesia, Republic of Korea). Although one Party has already implemented a wide range of these policies (Republic of Korea), most other Parties were at the stage of consideration, rather than implementation, of such policies.

A. Energy

115. All Parties reported on measures in the energy sector, including energy conservation and efficiency, fuel switching and renewable energy sources. In addition to the implementation of specific projects, Parties referred to the adjustment of domestic energy prices to international levels (Mexico, Republic of Korea). Energy security is an additional driver for proposing or implementing steps (Armenia, Mexico, Republic of Korea). Except for Jordan and Kazakhstan, Parties did not quantify the measures in terms of incremental costs and reduction of greenhouse gases.

116. Many Parties reported on measures relating to **energy efficiency** or **conservation**, which are either potential steps, steps at the planning stage or steps that have already been implemented. Two Parties (Kazakhstan, Republic of Korea) have implemented or are planning to implement an overarching energy efficiency plan. Others mention the implementation of energy efficiency projects (Mexico, Senegal, Zimbabwe). As part of economic restructuring, Armenia aims to achieve gains in energy efficiency through closing down outdated heat and power units.

117. Parties described **fuel switching**, mainly from coal and oil to gas, as an important measure to reduce emissions (Argentina, Armenia, Jordan, Kazakhstan, Mexico, Senegal). Two Parties (Kazakhstan, Senegal) stated that they would consider exploration of domestic gas-fields. Kazakhstan described a project for capturing coal-bed methane for combustion. As part of economic restructuring, the Republic of Korea intends to close down some of its coal mines. Armenia and the Republic of Korea intend to increase the share of nuclear power in the energy mix.

118. Parties stressed the development and promotion of **renewable energy** sources. Jordan and the Republic of Korea have adopted quantified targets and timetables to increase the share of new and renewable energy sources as part of their energy mix, 2 per cent by 2006 and 5 per cent by 2000, respectively. For many Parties (Argentina, Armenia, Kazakhstan, Republic of Korea, Senegal) the most important renewable option is the extension of their hydropower programmes, mainly through additional small-scale hydro projects. Other forms of renewable energy that are being considered are solar renewables (Federated States of Micronesia, Jordan, Kazakhstan, Mauritius, Republic of Korea, Zimbabwe), wind power (Federated States of Micronesia, Jordan, Kazakhstan, Republic of Korea) and biofuels (Jordan, Mauritius, Republic of Korea). Mauritius acknowledged the need for more investment to increase bagasse production through joint ventures.

Box 2. Approaches for identifying measures to address climate change

In the context of national circumstances, different approaches were adopted by Parties for identifying measures to address climate change. Some measures were based on quantitative indicators, while others reflected qualitative criteria based on the Party's development priorities.

Examples of target-oriented measures that focused on reducing **energy intensity** appeared in the communications of Kazakhstan and the Republic of Korea. Kazakhstan has adopted the energy intensity of OECD countries as its benchmark, and estimates that reaching that level would prevent the release of 170 million tonnes of CO_2 emissions. The Republic of Korea established a ten-year national plan for **energy technology development** (1997 to 2006) focusing on energy conservation technology, alternative energy technology and clean energy technology. Within the same framework, the Republic of Korea has set mandatory **energy performance standards** for appliances, and instituted energy intensity targets for 161 products, which have been implemented since 1992. Plans are also under way to use photovoltaic power for small islands with less than 50 households.

Measures that emanated from development priorities were mentioned by Jordan, where the abundance of insolation and wind power, and the scarcity of conventional energy sources, has led to a policy of increased utilization of **renewables**. Armenia, an economy in transition which is undergoing a process of upgrading its industrial infrastructure, is targeting measures for the **modernization of power stations** and increasing energy supply through exploiting renewable energy sources. Uruguay, whose beef production is an important economic activity, has identified measures targeted at reducing **methane emissions** from livestock breeding which at the same time improve the beef productivity of its livestock population. The Federated State of Micronesia, a small island state vulnerable to sea-level rise, have identified **measures to address climate change that double as adaptation measures**, such as coral reef protection.

In general, Parties are **switching away from the use of coal and oil** in favour of natural gas and non-fossil fuel energy sources, including nuclear energy, depending on availability and economic feasibility.

119. Some Parties reported on the promotion and use of **solar** energy technologies. The Republic of Korea has constructed photovoltaic plants of 160 KW, which generate electricity at a price comparable to diesel plants; solar thermal heating systems have also proven to be economical. The use of renewables in remote areas, for example solar thermal heating, is seen as contributing not only to addressing climate change but also to the economic development of these areas (Federated States of Micronesia, Senegal, Zimbabwe).

120. In the **industrial sector**, steps to conserve energy are being considered (Jordan, Republic of Korea, Senegal, Zimbabwe) and to improve the general environmental performance of industry (Mexico). The Republic of Korea has set stringent energy intensity targets and energy conservation plans for different branches of industry. Uruguay mentioned steps to reduce emissions from industrial processes, such as those from the production of cement. Zimbabwe has identified one of the barriers in the industrial sector to be the old capital stock. The Federated States of Micronesia do not have any industrial-process GHG emissions.

121. Regarding energy consumption in the **residential and commercial sector**, Parties mentioned energy efficiency or energy conservation (Argentina, Kazakhstan, Mauritius, Republic of Korea, Senegal), renewable energy sources (Argentina, Mauritius, Zimbabwe),

district heating (Kazakhstan) and the use of kerosene and agro-industrial waste for cooking instead of coal (Senegal). Mexico reported on an efficient lighting project undertaken under the AIJ pilot phase.

B. Transport

122. Measures in the transport sector varied significantly across reporting Parties, in terms of both planning and implementation. Among the measures being considered are better integration of urban planning, transport and environmental policies (Mexico), regular vehicle inspection (Mexico), phasing out older vehicles (Jordan, Senegal), improving public transport (Jordan, Mexico, Republic of Korea), increasing vehicle occupancy, improving fuel efficiency, better traffic management, increasing efficiency of freight transport, and speed reductions (Mauritius). Parties referred to tax policies (Jordan, Republic of Korea), fuel economy ratings and other standards (Republic of Korea), and the restructuring of relevant institutions (Jordan), as well as education and awareness raising in the transport sector (Mauritius, Mexico, Republic of Korea). The measures are largely at the planning stage.

C. Agriculture

123. Most Parties reported on the possibilities of reducing greenhouse gas emissions from agriculture. Measures reported by the Parties were diverse, and included crop conversion and shifting from intensive to extensive grain production, taking less productive land off crop rotation, and converting agricultural lands into grasslands (Armenia, Kazakhstan). The Republic of Korea reported ways to reduce methane emissions from rice paddy cultivation, including examining ways to promote consumption of staple foods other than rice. Four Parties underlined the need to reduce the use of fertilizers (Armenia, Federated States of Micronesia, Mauritius, Uruguay). Kazakhstan and Uruguay addressed emissions from livestock, for example through improved productivity and reduction in numbers. Mauritius mentioned banning sugar cane burning prior to harvest and encouraging integrated farming.

D. Waste management

124. Most Parties discussed measures in the waste management sector. Although waste handling and the associated environmental impact is a problem in almost all of the reporting countries, its link with greenhouse gas emissions was only discussed by Jordan, Mauritius and the Republic of Korea. Waste handling methods reported were sewage collection for liquid and solid wastes from households and industry, and the introduction of composting for household wastes (Senegal). Jordan, Mauritius, the Republic of Korea and Senegal mentioned the use of waste for energy purposes via biogas and waste incineration. Jordan and Senegal stressed the recovery of methane through composting household waste. Mauritius uses waste from its sugar industry to produce energy and mentioned promoting recycling and waste production measures. Mexico has a programme to minimize and manage industrial waste.

E. Enhancement of removals by sinks

125. Parties considered sinks as an important part of the measures to counter the adverse effects of climate change. The Federated States of Micronesia mentioned the strengthening of coral reefs as an option for enhancing removals by sinks. Five Parties listed concrete targets and timetables for afforestation, including national programmes (Kazakhstan, Mexico, Republic of Korea, Uruguay) and afforestation subsidies for private forests (Republic of Korea). Jordan and Kazakhstan mentioned the need for foreign direct investment in order to carry out their afforestation plans.

IX. RESEARCH, SYSTEMATIC OBSERVATION AND MONITORING

126. All of the Parties gave information on **research and systematic observation**. Armenia, Mauritius, the Republic of Korea, Uruguay and Zimbabwe dedicated chapters or sections to both, while the Federated States of Micronesia reported on research and Kazakhstan on observation separately. The scope, coverage, and level of detail of the information varied widely. Parties made reference to systematic observation activities (Argentina, Armenia, Kazakhstan, Mauritius, Mexico, Republic of Korea, Uruguay, Zimbabwe), including information on national meteorological, climate and hydrological networks and activities for monitoring and measuring greenhouse gas emissions and sinks.

127. Parties reported a wide spectrum of specific **research activities** with relevance to vulnerability assessment, assessment of options for adaptation and measures to address climate change and its adverse impacts, in addition to measures to develop the inventory of greenhouse gas emissions. Argentina, Uruguay and Zimbabwe stressed that, although a number of the studies undertaken were relevant to climate change, they did not have a structured framework for undertaking studies dedicated exclusively to climate change, and that such an initiative would require financial and technical assistance.

128. With regard to vulnerability assessment, specific studies have been undertaken by Parties on areas such as agriculture (Mauritius, Uruguay, Zimbabwe), livestock (Mauritius), fisheries (Uruguay), water resources (Jordan, Uruguay), coastal zones (Mauritius) and human health (Mauritius, Uruguay). Some Parties have also addressed environmental impacts (Argentina, Mauritius, Mexico, Senegal, Uruguay) and resulting social-economic impacts of climate change (Mauritius, Mexico, Uruguay). These studies varied from undertaking a general vulnerability assessment (Argentina, Armenia, Federated States of Micronesia, Jordan, Mauritius, Republic of Korea, Senegal, Uruguay, Zimbabwe) to analysing more specific issues such as the improvement of assessment models (Mauritius, Uruguay, Zimbabwe), the reduction of socio-economic and environmental uncertainty linked to the intensity of climate change impacts (Mexico, Uruguay), the use of climate change and economic scenarios (Republic of Korea), and the analysis of satellite imagery (Zimbabwe).

129. Studies of different adaptation options analysed specific adaptation tools or management systems designed to deal with possible impacts in the areas of the environment, forestry, agriculture, livestock, water resources, coastal zones and human health (Armenia, Federated States of Micronesia, Mauritius, Uruguay, Zimbabwe) (see table 14).

130. Research programmes on measures to address climate change concentrated on the energy sector, in particular with regard to ways of improving energy efficiency (Kazakhstan, Mauritius, the Republic of Korea, Uruguay, Zimbabwe) and of improving the feasibility of using different types of renewable resources (Armenia, Kazakhstan, Mauritius, Mexico, Republic of Korea, Zimbabwe). Specific studies on agriculture, forestry, waste management, industry and transport were also mentioned. Armenia, the Federated States of Micronesia, the Republic of Korea and Zimbabwe stressed the role of these studies as a basis for implementing national planning (see table 15).

131. Parties mentioned research programmes covering issues related to inventories, such as the role of social and economic activities in greenhouse gas emissions and characteristics of greenhouse gases (Republic of Korea), the study of GHG emissions from land-use practices in agriculture and forestry through remote sensing techniques and GHG emissions from the power sector at regional level (Zimbabwe), and stressed the need to expand national statistics and set up a database to develop projections (Mauritius, Republic of Korea).

132. Parties provided information on the institutional framework for undertaking studies by listing the national institutions carrying out research (Argentina, Mauritius, Republic of Korea, Zimbabwe), emphasizing their cooperation with private sector institutions and non-governmental organizations (Argentina, Mauritius, Republic of Korea, Senegal, Zimbabwe), and describing their participation in regional and international research programmes (Argentina, Armenia, Mexico, Republic of Korea, Uruguay).

133. The Federated States of Micronesia, Jordan, Mauritius and Uruguay also reported on planned research programmes that will be undertaken depending on the availability of financial and technical resources.

134. **Systematic observation** is being carried out on climate anomalies (Armenia, Kazakhstan, Republic of Korea), weather variability (Argentina, Armenia, Kazakhstan, Mexico, Republic of Korea, Uruguay, Zimbabwe), air temperature and humidity (Armenia, Jordan, Kazakhstan, Zimbabwe) and hazardous hydrometeorological phenomena, such as tropical cyclones, monsoon and El Niño (Armenia, Kazakhstan, Mauritius, Republic of Korea, Zimbabwe). Parties also reported information regarding observation of sea-level rise and sea temperature changes (Argentina, Mauritius, Republic of Korea, Uruguay), ocean/atmosphere interactions (Argentina, Uruguay), water quality (Armenia, Mauritius, Republic of Korea, Uruguay), terrestrial ecosystems (Argentina, Mauritius, Uruguay) and air pollution (Mexico, Republic of Korea).

135. A number of Parties made specific reference to the types and number of observation stations available, their national databanks, archiving activities, equipment and institutional arrangements (see table 16). In addition, Parties emphasized the use and development of global circulation models (Armenia, Kazakhstan, Republic of Korea), the development of meteorological technology (Armenia, Republic of Korea) and the publication of climatic data (Armenia, Kazakhstan). Armenia and Kazakhstan included some information on observable trends in air temperatures and precipitation.

136. Parties provided information on cooperation with international and regional programmes, in particular programmes coordinated by the World Meteorological Organization, such as the Global Air Watch (GAW), the Global Climate Observing System (GCOS), the World Climate Programme (WCP) and the World Weather Watch (WWW) (see table 17).

137. Over half the communications listed options for preparing adequate systems to monitor climate change impacts on terrestrial and marine ecosystems. The areas of focus included water resources, ecosystems and the environment in general.

138. Some Parties mentioned the need for systems to monitor water resources. Armenia mentioned developing a water monitoring system. Zimbabwe proposed improving the knowledge of groundwater storage as a means of meeting water requirements.

139. Mauritius made detailed proposals for responding to climate change impacts on terrestrial and marine ecosystems: establishing a mechanism to do systematic surveys of existing beaches, mangrove strands, and coral reefs by creating baseline maps evaluating degradation on a regular basis; gathering data in order to assess fish stocks, their sustainable yield, and depletion; and collecting data on changes in ocean circulation as they relate to temperature shifts.

140. Jordan mentioned the need to establish an environmental monitoring system so as to develop response strategies to climate change.

X. EDUCATION, PUBLIC AWARENESS AND TRAINING

141. All Parties reported on education, public awareness and training. Armenia, the Federated States of Micronesia, Kazakhstan, Mauritius, the Republic of Korea, Senegal, Uruguay and Zimbabwe dedicated a separate chapter or section to the subject.

142. In describing activities in the area of formal **education**, many Parties provided detailed information on initiatives taken in the area of climate change, while others described only a few specific projects to illustrate their general approach. Argentina, the Federated States of Micronesia, Kazakhstan and Uruguay emphasized the incorporation of climate change in education through curricular reform and dissemination of teaching materials for primary, secondary and/or high schools. Armenia, Mauritius and the Republic of Korea described climate change elements in curricula for environmental, energy and/or atmospheric studies. Jordan and

Senegal stressed that climate change education was an important part of their sustainable development plans.

143. Parties also gave an extensive account of other educational activities related to climate change such as the organization of, and participation in, international and/or regional educational programmes and workshops (Mauritius, Mexico, Republic of Korea), the organization of thematic lectures and courses (Armenia, Mexico), the preparation of special teaching material on the environment and/or climate change (Uruguay) and the publication of climate change studies. These activities related to atmospheric sciences (Argentina, Armenia, Kazakhstan, Mexico), energy conservation (Argentina, Armenia, Mexico, Republic of Korea), and the environment (Mauritius, Republic of Korea), or to information on the benefits of specific adaptation and mitigation options (Kazakhstan, Mexico).

144. Some Parties (Argentina, Kazakhstan, Mauritius, Mexico, Republic of Korea) mentioned collaboration with non-governmental organizations and private sector institutions in promoting informal education on climate change and in participating in the preparation of climate change educational material.

145. Although most of the formal educational activities were aimed at the general public, some also focused on local communities (Federated States of Micronesia, Republic of Korea, Zimbabwe), the private sector (Mexico, Republic of Korea, Zimbabwe), and decision makers and professional groups (Zimbabwe).

146. Apart from the organization of national workshops, Parties also reported on participation in and/or organization of regional workshops (Armenia, Mexico, Uruguay), the dissemination of teaching material (Federated States of Micronesia, Mexico, Republic of Korea) and dissemination of scientific, legal and technical information (Senegal).

147. **Public awareness** campaigns on climate change issues consisted of the dissemination of information through diverse materials and means, including pamphlets, brochures, newsletters, articles in newspapers, published studies, information kits, educational material, CD-ROMs, the Internet, audiovisual material, radio and television programmes, expositions and public talks and meetings (see table 18).

148. Parties mentioned their intention to integrate climate change awareness into national environmental and/or development plans (Federated States of Micronesia, Jordan, Mexico, Republic of Korea, Senegal and Uruguay). Others declared their willingness to strengthen institutional capacity through the development of national environmental information and/or training centres (Armenia, Federated States of Micronesia, Mauritius). Six Parties also referred to public awareness campaigns through non-governmental organizations, the private sector and local and/or traditional resources for disseminating and preparing materials (Argentina, Jordan, Kazakhstan, Mauritius, Republic of Korea, Uruguay).

149. Although most of the awareness activities reported were oriented towards the general public, some Parties also reported special awareness campaigns targeting specific groups such as local communities (Federated States of Micronesia, Mauritius, Republic of Korea, Zimbabwe), government officials (Armenia, Federated States of Micronesia, Zimbabwe), the industrial sector (Republic of Korea, Zimbabwe) and professionals (Uruguay, Zimbabwe). Campaigns vary from broad information on climate change and environmental concerns to specific issues such as the benefits of certain mitigation and adaptation options (Kazakhstan, Mauritius, Mexico, Senegal, Uruguay, Zimbabwe), energy conservation (Jordan, Republic of Korea) and natural resources conservation (Federated States of Micronesia, Jordan, Republic of Korea).

150. Specific needs for financial and technical assistance were identified for activities such as improvement of public and non-governmental organizations participation (Jordan) and of the use of Internet facilities, including by setting up a national web site (Zimbabwe).

151. **Training** activities, on the other hand, targeted mainly government policy-makers (Federated States of Micronesia, Jordan, Republic of Korea, Zimbabwe), government technical staff (Armenia, Federated States of Micronesia, Mexico, Republic of Korea, Uruguay, Zimbabwe), and specific segments of society such as the media (Uruguay), farmers (Republic of Korea, Zimbabwe) and the business community.

152. Most of the Parties (Armenia, Kazakhstan, Mauritius, Mexico, Senegal, Uruguay, Zimbabwe) made reference to training activities that took place as part of studies related to the preparation of their initial national communication. Specific training has also been provided on energy management and energy technology. The Republic of Korea has, for example, prepared energy management guidelines, while Zimbabwe has promoted training for farmers on the use of photovoltaic technologies. Training has also been provided on criteria for preparing climate change projects (for example, Mexico and Zimbabwe held training on AIJ project criteria, and Uruguay on the calculation of incremental costs); and on natural resource conservation. The Federated States of Micronesia have provided training on water conservation and fire dangers, while Mexico and the Republic of Korea have held training courses on forest resources conservation.

XI. FINANCIAL AND TECHNOLOGICAL NEEDS AND CONSTRAINTS

153. All Parties included information on financial and technological constraints associated with the communication of information. References were made to needs and constraints related to assessment of vulnerability to climate change, measures to facilitate adequate adaptation to the adverse impacts of climate change, and measures for addressing climate change.

Communication of information

154. The reports communicated financial and technological needs and constraints involved in the establishment of systems for the collection, collation, management and dissemination of data

and information. Specific mention was made of the need to obtain adequate information to facilitate effective decision-making by developing and enhancing capacity to carry out vulnerability and adaptation studies in specific areas of concern. Parties expressed the need for assistance to establish or upgrade stations for systematic observation of the climate system, and environmental monitoring systems (Armenia, Jordan, Kazakhstan, Mauritius, Uruguay, Zimbabwe), training in modelling climate change scenarios (Argentina, Mauritius), identification of environmental impacts of infrastructure projects, and impacts of climate change on the hydrology of main river catchments (Jordan).

Assessment of vulnerability to climate change

155. Financial and technological needs and constraints were also expressed by several Parties with a view to receiving assistance in collecting data and developing modelling skills related to climate change impacts (see table 19).

156. On impacts on agriculture and food security, assistance would be required by Mauritius and Senegal. For the assessment of the vulnerability of the coastal zones, assistance would be needed by the Federated States of Micronesia, Mauritius, Senegal and Uruguay. For the water resources sector, assistance was mentioned by Jordan, Mauritius and Senegal, and for assessing the vulnerability of natural ecosystems, forestry and human health by Mauritius and Zimbabwe.

Measures to facilitate adaptation

157. Most Parties reported on financial and technological needs and constraints for measures to adapt to the adverse impacts of climate change (see table 20). Some Parties expressed the need for research and monitoring, as well as institutional capacity-building, in order to be able to assess possible options and develop response strategies. The importance of having access to appropriate technologies to counter the adverse impacts of climate change was also stressed by some Parties (Federated States of Micronesia, Mexico, Uruguay).

158. Parties also reported their need for assistance for effective adaptation in the agricultural sector. Specifically, Armenia, Kazakhstan, Mauritius and Zimbabwe require assistance to improve genetic varieties of crops and/or livestock. Other adaptation options mentioned were the diversification of agricultural products (Armenia, Mauritius, Zimbabwe), sustainable agricultural practices (Kazakhstan) and adoption of traditional agricultural methods to cope with El Niño effects (Federated States of Micronesia), assuming assistance is provided. Kazakhstan expressed the need for assistance in taking measures to preserve genes of wheat varieties, reduce soil erosion, effectively manage agricultural pests and disease outbreaks, and put in place a legal framework to ensure food security and sustainability of the agricultural sector. Mauritius needs assistance for increasing fish production through aquaculture.

159. In the area of coastal zone management, the Federated States of Micronesia expressed the need for assistance to develop a coral reef protection programme as well as a waste management

system to protect the coastal ecosystem. Assistance is also needed for the transfer of adaptation technology to cope with adverse effects, such as sea-level rise, and to ensure conservation and sustainable use of coral reefs (Federated States of Micronesia) as the most effective proactive response to projected sea-level rise.

160. In the water resources sector, Armenia, the Federated States of Micronesia, Jordan, Mauritius and Zimbabwe noted that they require assistance to build capacity for the effective management of their water resources. The need for modern technologies was also emphasized (Jordan, Kazakhstan, Zimbabwe). Specific mention was made of the need to develop infrastructure for the increased accumulation of water as well as the development of efficient irrigation systems, rational use and reuse of water and monitoring of national water resources.

161. For the protection of natural ecosystems, Armenia indicated the need for assistance in the creation of optimum landscape zones, forest and wildlife reserves for the protection of endangered species, preservation of gene materials in seed banks for the most vulnerable and valuable species and the monitoring of vulnerable ecosystems.

Measures for addressing climate change

162. Most of the Parties indicated their need for assistance in undertaking specific activities and implementing measures concerning climate change. In some cases, the need for assistance in research and institutional capacity-building was expressed as a first step to assess possible further options in different sectors (Jordan, Mauritius, Uruguay, Zimbabwe) (see table 21).

163. Argentina and Jordan mentioned the need to develop regional centres for the transfer of technology or for training to undertake climate change related activities. Jordan mentioned the need for assistance to build institutional capacity in different sectors through the establishment of research centres, implementation of demonstration projects, and transfer of environmentally sound technologies; and, to implement projects in the areas of energy efficiency, fighting forest fires, public awareness, and the development of regulations.

164. In the energy sector, improving the efficiency of current energy systems through the application of highly efficient technologies (Armenia, Kazakhstan, Uruguay) and increasing the use of renewable energy, such as solar, hydro and wind (Armenia, Federate States of Micronesia, Kazakhstan, Mauritius, Uruguay, Zimbabwe), were the most commonly considered measures to reduce greenhouse gas emissions, provided that both financial and technical assistance, and a facilitative legal framework, are available. Armenia requested assistance to implement measures to maintain minimal greenhouse gas emissions. Specifically these relate to the application of highly efficient technologies to existing power stations, increased deployment of renewable energy, and subsequent reduction of emissions of carbon dioxide. Kazakhstan requested assistance to put in place enabling mechanisms to implement a law on energy-saving projects. Some Parties expressed the need for assistance in increasing energy efficiency in fossil-fuel power plants through the programmes of modernization and rehabilitation, energy conservation,

installation of small hydropower plants, implementation of wind energy and methane utilization projects, as well as increased use of renewables and natural gas. The Federated States of Micronesia want to promote the use of solar energy. Mauritius wants to build expertise and acquire hardware for the use of renewable energy technologies. Uruguay needs assistance to remove market obstacles to renewable energy penetration, for energy efficiency improvements and for the development of incentive mechanisms for the implementation of measures.

165. Mauritius requested assistance to develop an efficient public transport system and the use of electric vehicles as well as cars with low fuel consumption, together with measurers for the increased use of renewable energy technologies, and improvement in energy efficiency to reduce national emissions of greenhouse gases. Assistance was also requested to develop and implement public awareness programmes to encourage the efficient use of energy.

166. In the industrial sector, some Parties mentioned the need for assistance to implement energy efficiency and energy saving measures, for example, through the replacement of existing industrial equipment by more efficient technologies (Armenia, Kazakhstan, Mauritius, Zimbabwe), energy efficiency and energy saving measures (Armenia, Kazakhstan), and renewable energy options (Mauritius) as well as the introduction of alternative technologies. Assistance is required by Zimbabwe to reduce emissions from the residential and commercial sector and Jordan requested assistance to raise awareness of the need to reduce emissions from small and medium-sized enterprises.

167. Activities in the forestry sector such as afforestation and reforestation were mentioned by three Parties (Federated States of Micronesia, Jordan, Zimbabwe) as needing assistance.

XII. OTHER INFORMATION

Needs and constraints in the preparation of initial national communications

168. Most Parties reported on the financial and technical constraints in preparing their initial national communications. Information regarding needs and constraints in preparing national communications has often been treated along with needs and constraints associated with communication of information in general and/or the national capacity to implement the Convention and undertake specific research. These issues are dealt with in section XI of this document.

List of projects

169. Parties provided in their initial national communications information on various initiatives related to the implementation of projects, in accordance with Article 12.4 of the Convention. The extent of coverage and level of detail varied. While Armenia, Jordan and Zimbabwe provided separate sections containing a list of proposed projects for funding, other

Parties mentioned various activities, plans and priorities related to preparation of projects but did not explicitly put forward projects for funding.

170. Armenia submitted, as an addendum to its initial national communication, a list of 17 projects for funding, for most of which estimated costs were provided. Jordan provided detailed information on eight projects including information on the project background, location, implementation plan, estimated costs and duration in varying level of detail. It further provided a list of 10 other project titles with estimated costs. Zimbabwe proposed four project activities for funding under the heading of mitigation activities. The communication indicated that the incremental cost and emission reduction potential of the projects are documented in two mitigation studies which were only referenced in the communication. Zimbabwe further indicated that external support would be required for the development of the proposals.

171. In addition, some Parties reported on their efforts to estimate incremental costs (Jordan, Mexico, Uruguay, Zimbabwe) and to improve the participation of the private sector in projects (Mauritius, Senegal, Uruguay, Zimbabwe). Some Parties (Kazakhstan, Mexico, Zimbabwe) also mentioned the implementation of projects under the pilot phase of activities implemented jointly.

172. Priority areas identified for projects included the development of sinks (Argentina, Mexico, Zimbabwe), access to renewable energy (Jordan, Mauritius, Uruguay, Zimbabwe) and technology (Jordan, Kazakhstan, Uruguay, Zimbabwe), and the improvement of energy efficiency (Jordan, Kazakhstan, Mauritius, Mexico, Senegal, Uruguay, Zimbabwe).

Projections

173. Projections of greenhouse gas emissions, although not requested by the UNFCCC guidelines, were provided by five Parties. The degree of coverage regarding years, gases and sectors varied among Parties; however, the five Parties all provided *energy* CO_2 emissions projections. In addition, another two Parties, Jordan and Senegal, provided energy demand projections. Two Parties also provided CH_4 projections, while N_2O projections were provided by one Party. Projections related to the *land-use change and forestry* sector were provided by Zimbabwe. Projections were most commonly reported for the years 2000 and 2010 (see box 3). In three cases (Armenia, Mauritius, Republic of Korea), energy demand forecasts and projections of GHG emissions were reported in conjunction with considerations of GHG limitation strategies and/or identification of GHG reduction potentials.

Box 3. Reporting of information on projections

Party	Projected years	Gases and sectors or source categories
Armenia	2000, 2005, 2010	CO_2: fuel combustion, industrial processes, total CO_2 (excl. LUCF) CH_4: fugitive fuel emissions, livestock, waste, total CH_4 Aggregate GHG in CO_2 equivalent
Kazakhstan	2000, 2005, 2010, 2015, 2020	CO_2: energy supply sector
Mauritius	2000, 2005, 2010, 2015, 2020	CO_2: total CO_2 (excluding LUCF)
Republic of Korea	2000, 2005, 2010	CO_2: energy
Zimbabwe	2010, 2050	CO_2: energy, industrial processes, land-use change and forestry CH_4: industrial processes, agriculture, land-use change and forestry, waste N_2O: industrial processes, agriculture, land-use change and forestry Aggregate GHG in CO_2 equivalent

174. It is important to emphasize that projections provided by Parties are not comparable. As is the case with Annex I Parties, non-Annex I Parties used different models and key input assumptions, and included different source categories in their projections. Differences in projections are also a consequence of uncertainties due to national circumstances and the fact that some Parties provided "without measures" scenarios while others assumed full implementation of planned mitigation activities. Thus, the numerical data presented are intended to facilitate an appreciation of the order of magnitude of greenhouse gas emissions expected in the future for those Parties that provided projections (see annex, tables B.1 and B.2).

175. The data provided reveal that CO_2 emissions, mainly from the *energy* sector, will have increased significantly in 2000, compared to 1990 levels, for two of the reporting Parties (Mauritius, Republic of Korea). The two reporting Parties that are in transition to a market economy (Armenia, Kazakhstan) projected emissions to decline sharply by 2000, but predict that they will rise subsequently and in one case (Kazakhstan) will reach 1990 levels. Zimbabwe projected an increase in emissions for all three gases (CO_2, CH_4 and N_2O) by 2010. CO_2 emissions from land clearing in the *land-use change and forestry* sector are also projected to increase, while removals will decrease.

Tables

Table 1. Paragraphs of UNFCCC guidelines and SBSTA conclusions relevant to the reporting of inventory data

UNFCCC guidelines (decision 10/CP.2, annex):	
Paragraph 8	The Guidelines for the National Greenhouse Gas Inventories and Technical Guidelines for Assessing Climate Change Impacts and Adaptation or the simplified default methodologies adopted by the Intergovernmental Panel on Climate Change (IPCC) should be used by non-Annex I Parties, as appropriate and to the extent possible, in the fulfilment of their commitments under the Convention.
Paragraph 9	Information should be provided the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), to the extent the Party's capacities permit. In addition, Parties are encouraged to include in their national inventories the fully-fluorinated compounds, as appropriate. Other greenhouse gases included in the IPCC methodology may be included at the discretion of the Parties. Emissions from bunker fuels should be reported separately from national emissions.
Paragraph 10	Parties should strive to present the best available data in a table (see table II below), to the extent their capacities permit, and try to identify the areas where the data may be further improved in future communications through national capacity building.
Paragraph 14	Non-Annex I Parties should provide the best available data in their inventory. To this end such data should be provided for the year 1994. Alternatively, non-Annex I Parties may provide such data for the year 1990.
SBSTA conclusions: The SBSTA, at its fourth session, recalled decision 10/CP.2, and encouraged non-Annex I Parties to apply the Revised 1996 Guidelines, as appropriate and to the extent possible, in communicating their national greenhouse gas inventories (FCCC/SBSTA/1996/20, paragraph 30 (b)). Also at its fourth session, the SBSTA encouraged Parties to report actual emissions of HFCs, PFCs and SF_6, given that these better reflect the real releases to the atmosphere and encouraged Parties which are not in a position to report actual figures to report potential emissions (FCCC/SBSTA/1996/20, paragraph 31).	

Table 2. Completeness of reporting according to the IPCC Guidelines (1990 and/or 1994)

GHG source category	CO_2		CH_4		N_2O	
	Reporting Parties	% of total	Reporting Parties	% of total	Reporting Parties	% of total
I.A. Fuel combustion	**10**	**100 *(100)***	**10**	**100 *(100)***	**10**	**100 *(100)***
1. Energy industries	9	90 *(91)*	7	70 *(79)*	8	80 *(82)*
2. Manufacturing industries and construction	10	100 *(91)*	7	70 *(82)*	7	70 *(74)*
3. Transport	10	100 *(94)*	8	80 *(91)*	9	90 *(85)*
4. Small combustion	10	100 *(94)*	8	80 *(85)*	8	80 *(76)*
5. Other	7	70 *(68)*	3	30 *(41)*	3	30 *(32)*
6. Biomass burning	2	20 *(32)*	5	50 *(29)*	5	50 *(18)*
I.B. Fugitive fuel emissions	**1**	**10 *(53)***	**9**	**90 *(88)***	-	- *(9)*
1. Solid fuels	-	- *(15)*	7	70 *(71)*	-	- *(-)*
2. Oil and natural gas	1	10 *(47)*	8	80 *(82)*	-	- *(9)*
II. Industrial processes	**10**	**100 *(100)***	**3**	**30 *(53)***	**3**	**30 *(79)***
A. Mineral products	9	90 *(68)*	1	10 *(-)*	1	10 *(-)*
B. Chemical industry	3	30 *(32)*	2	20 *(24)*	2	20 *(50)*
C. Metal production	2	20 *(50)*	2	20 *(18)*	-	- *(3)*
D. Other production	2	20 *(32)*	1	10 *(3)*	-	- *(3)*
III. Solvent use	-	- *(21)*	-	- *(-)*	-	- *(26)*
IV. Agriculture	-	- *(12)*	**10**	**100 *(100)***	**9**	**90 *(100)***
A. Enteric fermentation	-	-	10	100 *(97)*	-	- *(-)*
B. Manure management	-	-	10	100 *(91)*	-	- *(15)*
C. Rice cultivation	-	-	7	70 *(35)*	-	- *(9)*
D. Agricultural soils	-	- *(12)*	-	- *(21)*	6	60 *(85)*
E. Prescribed burning of savannas	-	-	5	50 *(3)*	5	50 *(3)*
F. Field burning of agricultural residues	-	-	8	80 *(38)*	8	80 *(24)*
G. Other	-	-	1	10 *(-)*	-	- *(-)*
V. Land-use change and forestry	10	100 *(91)*	5	50 *(44)*	5	50 *(41)*
A. Changes in forest and other woody biomass stock	10	100 *(88)*	-	- *(3)*	-	- *(6)*
B. Forest and grassland conversion	9	90 *(32)*	5	50 *(26)*	5	50 *(15)*
C. Abandonment of managed lands	6	60 *(7)*	-	- *(-)*	-	- *(-)*
D. CO_2 emissions and removals from soils	2	20 *(9)*	-	- *(-)*	-	- *(-)*
E. Other	-	- *(15)*	-	- *(15)*	-	- *(15)*
VI. Waste	**2**	**20 *(41)***	**10**	**100 *(97)***	**1**	**10 *(53)***
A. Solid waste disposal on land	-	- *(15)*	10	100 *(97)*	-	- *(-)*
B. Waste-water handling	-	- *(3)*	10	100 *(74)*	-	- *(24)*
C. Waste incineration	2	20 *(32)*	1	10 *(35)*	-	- *(41)*
D. Other	-	-	1	10 *(6)*	1	10 *(-)*
VII. Other	-	- *(3)*	-	-	-	- *(-)*
International bunker	**5**	**50 *(71)***	**1**	**10 *(35)***	**2**	**20 *(35)***

Notes:

Sources reported as not occurring (NO) were considered as reported in this table. Sources reported as NE (not estimated) or NA (not applicable) were not considered as reported.

IPCC sectors or source categories reported by 80 per cent or more of the reporting non-Annex I Parties are given in shaded cells. The values given in italics and in parentheses indicate the percentage of reporting by Annex I Parties, for purposes of comparison. These values are taken from document FCCC/SBSTA/1998/7, table 18.

Table 3. Confidence levels[a] of emission estimates

Gas and source	Kazakhstan	Mauritius	Uruguay	Zimbabwe
CO_2				
Fuel combustion	80-95	H	H	95
Industrial processes	*[b]	H	H	*[c]
Land-use change and forestry	*[b]	M	M	80-90
CH_4				
Fuel combustion	*[b]	H	L	*[c]
Fugitive fuel emissions	40		L	*[c]
Livestock	75	M	M	*[c]
Other agriculture	*[b]		M	*[c]
Waste	*[b]	M	M	80-90
N_2O				
Fuel combustion	*[b]	H	M	*[c]
Chemical industry	*[b]	M		*[c]
Agricultural soils	*[b]	M	M	*[c]

[a] The secretariat uses the term "confidence levels" in compiling data provided by Parties using different terms: uncertainties, error range, accuracy, etc. Confidence levels are given in per cent. For Parties that reported on uncertainties qualitatively the following codes were used: High (H); medium (M); low (L).

[b] Kazakhstan reported that errors of the emission estimates for the *energy* sector are estimated to be 5-20 per cent, except for the residential sector where errors may exceed 20 per cent. It was further stated that except for *fugitive fuel* emissions and CH_4 emissions from *livestock*, for the rest of the source categories the level of uncertainty varies from 20-80 per cent.

[c] Zimbabwe reported that the level of confidence for the commercial use of energy is over 95 per cent, while the accuracy for agriculture, industrial processes, land-use, forestry and waste management is between 80 and 90 per cent.

Table 4. Coverage of IPCC sectors, subsectors and source categories not explicitly requested by the UNFCCC guidelines

Sector	CO_2	CH_4	N_2O
Energy	Total fugitive fuel emissions *- Solid fuels* *-Oil and natural gas*	*- Energy industries* *- Manufacturing industries and construction* *- Transport* *- Small combustion*	*- Manufacturing industries and construction* *- Transport* *- Small combustion* *- Other (fuel combustion)* Total fugitive fuel emissions *- Solid fuels* *- Oil and natural gas*
Industrial processes	No split of industrial process emissions into subsectors is requested. Reporting of national totals of industrial processes is only requested for CO_2 and N_2O emissions.		
Agriculture		***- Manure management*** *- Agricultural soils* ***- Field burning of agricultural residues***	*- Manure management* *- Agricultural soils* *- Prescribed burning of savannas* ***- Field burning of agricultural residues***
Land-use change and forestry	*- CO_2 emissions and removals from soils* *- Other land-use change and forestry*	Total land-use change and forestry *- Forest and grassland conversion* *- Other land-use change and forestry*	Total land-use change and forestry *- Forest and grassland conversion* *- Other land-use change and forestry*
Waste	Total Waste *- Solid waste disposal on land* *- Waste incineration* *- Other waste*	**Total waste** ***- Solid waste disposal on land*** ***- Waste-water handling*** *- Waste incineration* *- Other waste*	Total waste *- Waste-water handling* *- Waste incineration* *- Other waste*
Memo items	International bunkers CO_2 emissions from biomass	International bunkers	International bunkers

Notes:

Subsectors and source categories to be reported according to the IPCC Guidelines but that are not explicitly requested by table II in the annex to the UNFCCC guidelines are given in *italics*. The table also indicates the IPCC sectors and subsectors for which no totals are requested. Shaded cells indicate that emission estimates from these sectors, subsectors and source categories were reported by more than 80 per cent of the reporting Parties, even though this information was not explicitly requested by the table in the FCCC guidelines.

Table 5. Share of IPCC source categories not requested by the UNFCCC guidelines in total emissions

Party	CO_2	CH_4	N_2O	Aggregate GHG in CO_2 equivalent
	(per cent of total)	(per cent of total)	(per cent of total)	(per cent of total)
Argentina 1990	1	14	100	**5.9**
1994	1	19	98	**7.9**
Armenia	0	19	77	**2.6**
Jordan	21	94	65	**23.6**
Kazakhstan 1990	0	11	48	**1.7**
1994	0	15	0	**2.7**
Mauritius	0	86	60	**10.6**
Mexico	0	24	99.5	**5.6**
Republic of Korea	0	41	86	**5.3**
Senegal	0	48	87	**28.7**
Uruguay 1990	0	10	100	**40.7**
1994	0	10	100	**39.2**
Zimbabwe	0	15	33	**7.7**

Notes:

The percentages given in the last column of this table represent the share of GHG emissions obtained from the IPCC source categories not explicitly included in table II of the UNFCCC guidelines in aggregate GHG emissions in CO_2 equivalent. The respective shares in each of the gas totals are also shown.

Table 6. Status of reporting using the IPCC reporting framework

Party	IPCC sectoral information							Comparison with reference approach (CO_2 fuel combustion) [a]	
	Sectoral reports	Worksheets[b]					Standard data tables	Difference (%)	
		E	IP	A	LUCF	W			
Argentina	-	-	-	4-1 (CH_4)	-	-	E and IP	-	-
Armenia	-	-	-	-	-	-	E[c]	X	1
Jordan	-	1-1	-	4-1 (CH_4), 4-3, 4-4	5-1, 5-2, 5-3, 5-4, 5-5	6-1, 6-2 & 6-3	E	X	2.4
Kazakhstan	-	-	-	-	-	-	-	X	10
Mauritius	X	1-1, 1-2, 1-3, 1-4, 1-5	2-2, 2-7, 2-13	4-1, 4-5	5-1	6-1	-	X	0
Mexico	-	-	-	-	-	-	-	X	4.9
Republic of Korea	-	-	-	-	-	-	-	-	-
Senegal	-	1-1, 1-3, 1-5	2-1	4-1 (CH_4), 4-2, 4-3, 4-4;	5-1, 5-2, 5-3	6-1, 6-2, 6-3	-	-	-
Uruguay	X	1-1, 1-2, 1-3, 1-4, 1-5, 1-7, 1-8, 1-9	2-1, 2-2, 2-5, 2-9, 2-12, 2-13	4-1, 4-2, 4-3, 4-4, 4-5	5-1, 5-5	6-1, 6-2, 6-3, 6-4	-	X	+6.5 (1990) +1.2 (1994)
Zimbabwe	-	1-1, 1-3, 1-4	2-1	4-1(CH_4), 4-3 (modified), 4-4	5-1, 5-2, 5-3	6-1, 6-2	-	X	25

Notes:
The following abbreviations have been used:
E: Energy **LUCF:** Land-use change and forestry **A:** Agriculture
IP: Industrial processes **W:** Waste

[a] Comparison of CO_2 emission estimates from *fuel combustion* with those obtained using the IPCC reference approach. Differences as a percentage relative to the estimates obtained with the sectoral approach, which are set at 100 per cent in this table. For Armenia, Jordan, Mauritius, Mexico, Uruguay and Zimbabwe, the difference given in this column was calculated by the secretariat based on the numerical data provided in the communications. For Kazakhstan, the value given is as reported by the Party.

[b] In some cases, the numeration of worksheets refers to the Revised 1996 IPCC Guidelines, while in others, numeration refers to the 1995 version of those guidelines. A few Parties also added worksheets which are not part of the IPCC Guidelines.

[c] Standard data table without including values for emission factors.

Table 7. Types of emission factor used and level of documentation

IPCC category	Types of emission factor used				Level of documentation		
	IPCC defaults	Country-specific	Mix of defaults and country-specific	No information	Comments or source referenced	No sectoral information provided	Values given
	Percentage of reporting Parties						
Energy							
Fuel combustion	70		30		60	40	60
Fugitive fuel	100				38	63	38
Industrial processes	90			10	60	40	60
Agriculture							
Livestock	80		10	10	30	70	60
Other agriculture	60		30	10	50	50	70
Land-use change and forestry	50		40	10	60	40	60
Waste							
Solid waste	60	10	20	10	70	30	50
Waste water	44	11	33	11	56	44	44

Table 8. Problems encountered by the Parties in the preparation of GHG emission inventories

Party	Type of problem			Affected sectors, subsectors, source categories and gases
	Activity data	Emission factors	Methods	
Argentina	X			Agricultural soils, savanna burning, field burning of agricultural residues, and land-use change and forestry
Armenia			X	Solvent and other product use
Kazakhstan	X			Fuel combustion source categories, oil and natural gas, industrial processes, forest and grassland conversion, waste water (activity data gathered differently in 1990 and 1994)
Mauritius	X			Solvent use; waste (land disposal)
Republic of Korea	X	X		Fuel combustion (non-CO_2): IPCC emission factors are not suitable for the available data: to apply IPCC non-CO_2 emission factors requires final energy consumption data by sector and by end-user. Such data are not available Industrial processes (non-CO_2), agriculture, land-use change and forestry (non-CO_2), waste
Senegal	X			Feedstocks Livestock (different methods for gathering of activity data in 1991 and 1994)
Uruguay	X	X	X	Energy, industrial processes, agriculture, land-use change and forestry (non-CO_2), waste (CO_2, N_2O)
Zimbabwe	X		X	Bunkers, industrial processes, explosives used in mining operations (N_2O), livestock, agricultural soils, savanna burning, abandonment of managed lands and other land-use change and forestry source categories, waste (unaccounted dumps)

Table 9. Identification of areas for further improvement in the preparation of GHG emission inventories by Parties

Party	Areas for further improvement
Argentina	Identification of country-specific emission factors (in particular for *transport*) Research on contribution of mining activities to total GHG emissions Need to establish a statistical system which provides basic information on GHG emitting activities
Armenia	Specification and application of national emission factors for CH_4 emissions from *agriculture* and *waste*; higher degree of precision through introduction of detailed technology-based methodology
Jordan	Determination of local emission factors for energy production and consumption, industrial processes, *agriculture* and *land-use change and forestry* Measurement of emission factors for all identified sectors Establishment of an environmental monitoring system for air, waste water, and dust
Kazakhstan	Application of 1996 IPCC Guidelines and use of new data available, refinement of fuel combustion source category data for 1994
Mauritius	Improved statistics to allow for better data gathering for periodic GHG inventor es; need to obtain the data at a higher disaggregation level Need to centralize all climate change related data
Mexico	Inclusion of *solvents* and some *industrial processes* sources Establishment of procedures for the annual preparation of the inventory
Republic of Korea	Inclusion of source categories not covered so far Modification of collecting and processing inventory data (non-CO_2 for *industrial processes, agriculture, land-use change and forestry* and *waste*)
Uruguay	Improvement of the quality, collection and processing of data Identification of local emission factors
Zimbabwe	Importance of reliable databases to meet the IPCC/UNFCCC requirements , including building of GHG databases for future national communications Reviewing, updating and systematic dissemination of climate change data Quantitative research into sectoral GHG emissions Need to improve GHG inventory methods

Table 10. Examples of *good practices* applied by Parties in the GHG inventories

Party	Use of country-specific methods or models	Comparison of estimates obtained using national and IPCC default methods	Use of national and/or regional emission factors
Argentina	Rice cultivation Method based on the thermic regime of the soil during the cultivation period	Rice cultivation Difference: around 1 %	
Armenia	Waste Calculations based on measurement of the amounts of waste and waste water, and use of local values of appropriate coefficients.	Waste Difference: 13 per cent	Land-use change and forestry own coefficients for carbon fraction of dry matter and annual biomass growth Waste: own coefficients
Jordan			Energy: IMPACT database of the Energy and Power Evaluation Programme, locally available data for domestic fuel properties
Kazakh-stan	Industrial processes (carbide production) Method based on the chemical process of carbide production		
Mexico	Land-use change and forestry: Creation of a model which follows the counting procedure of the IPCC, allowing more flexibility regarding changing parameters using multiple estimations and sensitivity analysis		Land-use change and forestry: Use of own emission factors where local information was available
Republic of Korea		Rice cultivation Difference: estimates using IPCC emission factors are larger by 19%	Rice cultivation Regional emission factors derived from actual measurements
Senegal			Country-specific coefficients have been used for: biomass (*energy*), agricultural waste burning, some land-use change and forestry sources
Uruguay	Waste water Calculation based on quantities of waste water treated anaerobically		
Zimbabwe	Industrial processes: (except cement production) Balanced chemical equations of the resources transformation processes; actual measurements at the fertilizer plant. Savanna burning: Method involves modelling the processes of modelling the accumulation of combustible matter in relation to patterns in specified areas. Satellite-derived estimates used to calculate amount of biomass burnt.		Use of own emission and conversion factors for some land-use change and forestry source categories Waste water: fraction of waste water treated anaerobically

Table 11. Improvements introduced in updates[a] of inventories

Party	Improvements
Argentina	1. Inclusion of additional sectors: *land-use change and forestry, agricultural soils, savanna burning, burning of agricultural residues* 2. Improvements in basic information. 3. CH_4 emissions from *enteric fermentation* and *manure management*: recalculated using the tier 2 IPCC methodology (instead of tier 1) 4. Improvements in the reporting: - *Industrial processes*: detailed description of calculation method used - *Oil and natural gas*: Calculations to estimate *fugitive fuel* emissions - *Agriculture*: worksheet 4-1 provided; description of methodology used to estimate CH_4 emissions from *rice cultivation* - *Waste*: description of methodology used to estimate CH_4 emissions from *solid waste* and *waste water* (domestic and industrial)
Jordan	Improvements in reporting: - Worksheet 5-5 and 5-5A (change in soil carbon for mineral soil) provided - Inclusion of the source 'agriculturally impacted soils' - *Fuel combustion* (CH_4 and N_2O): disaggregation of estimates by subsectors (*energy and transformation industries, industry, transport, small combustion*)
Kazakhstan	Refinements of the 1990 inventory were made, e.g. in fuel consumption data.
Mexico	Updates were made regarding: - Energy generation - *Agriculture* (improved methods to gather the data for CH_4 emissions from livestock) - *Land-use change and forestry* (more precise estimates due to better knowledge of deforestation rates and carbon sequestration from administrated and abandoned lands)
Senegal	*Agriculture* (livestock): Improved data collection methods
Uruguay	1. Use of 1996 IPCC Guidelines 2. Changes in methodologies: - *Fuel combustion*: new tier 1 method (CO_2 and non-CO_2), new tier 2 for aviation; difference between the sectoral and the reference approach has diminished as a consequence of improvements in methodologies - *Industrial processes*: new method for calc production and use of acetylene gas - *Agriculture*: modified method to estimate CH_4 from *rice cultivation* - *Land-use change and forestry*: method to estimate change in carbon content in soils used for crops, grassland and pasture - *Waste*: new classification for disposal sites, new CH_4 correction factor 3. Changes in activity data: revision of energy balance; availability of data for production, import, export and stock change of lubricants; updated population data available(*waste*)
Zimbabwe	It was stated that with experience gained from the country studies on climate change, the Party is now in a better position to conduct more comprehensive assessments of inventories

Note :

Argentina, Jordan and Uruguay updated the inventories provided in their initial national communications. For Kazakhstan, Mexico, Senegal and Zimbabwe, improvements are in relation to inventories submitted prior to the initial national communications.

Table 12. National circumstances

National circumstances (non-Annex 1)	Argentina (1994)[a]	Armenia (1995)[b]	Federated States of Micronesia (1994)	Jordan (1994)	Kazakhstan (1994)	Mauritius (1995)	Mexico (1996)[a]	Republic of Korea (1996)[b]	Senegal (1994)[a]	Uruguay (1994)[a]	Zimbabwe (1994)
Population (millions)	34.6	3.76	0.106	4.14	16.2	1.1	91.2	45.5	8.1	3	10.64 ('93)
Area (sq km)	2 791 810	29 800	701	90 000	2 724 900	2 040	1 964 381.7	99 313	196 722	176 000	390 000
GDP (US$ million)	278 585.7	1 290	205.5	5 900	41 000	3 424 (GNP in US$)	334 790	457 000 ('95)	2 155.0 (billion F CFA)	16 269	4 971.88
GDP per capita (US$)	8 180	348	1 962	1 450	2 442	60 953 (GNP in MUR)	3 670.9	10 124 ('95)	253 306 (F CFA)	7 710	467.35
Estimated share of the informal sector in the economy in GDP (%)	N/A	N/A	21.8	5	15	N/A	N/A	N/A	N/A	N/A	not known
Share of industry in GDP (%)	30	29	10.4 (fisheries)	14.5	29.1	33	28.8	76.2	18.1	17.8	28
Share of services in GDP (%)	64.7	24	49	57.5	42.8	11	65.3	50.3	52.6	63.9	5
Share of agriculture in GDP (%)	5.3	40	0.8	4.5	14.9	10	5.9	6.4 ('95)	20	10	12
Land area used for agricultural purpose (sq km)	340 000	1,391,400 (ha)	250	500	2 222 500	86 500 (ha)	N/A	21 925 (22.1%)	3 800 000 (ha)	6 000	10 738 077 (ha)
Urban population as percentage of total population	87	69	25	70	56.4	N/A	60	N/A	63.4	89	31

Table 12. (continued)

Livestock population (thousands)	74 057	N/A	49	1 092	36 965.9	28.5[c]	43 167	92 738	9 737.0[c]	N/A	10 006
Cattle	53 157	N/A	N/A	58	8 072.9	16.5[c]	23 234	3 394	2 103.0[c]	N/A	5 154.3
Chicken	N/A	N/A	N/A	N/A	N/A	N/A	N/A	82 829	N/A	N/A	N/A
Pigs	N/A	N/A	49	N/A	1 982.7	N/A	10 053	6 515	161.0[c]	N/A	221.1
Sheep	16 922.6	N/A	N/A	182	25 132.1 (+goats)	1.5[c]	3 887	N/A	3 821.0[c]	N/A	404.1
Goats	3 978	N/A	N/A	852	see above	10.0[c]	5 993	N/A	3 213.0[c]	N/A	4 227.3
Horses	N/A	N/A	N/A	N/A	1 636	0.5[c]	N/A	N/A	434.0[c]	N/A	N/A
Camels	N/A	N/A	N/A	N/A	141.2	N/A	N/A	N/A	5.0[c]	N/A	N/A
Forest area (sq km)	360 000	334 100 (ha)	549	1 500	105 000	57 059 (ha)	1 417 000	65 396 (65.9%)	11 660 000 (ha)	N/A	20 500 000 (ha)
Population in absolute poverty (%)	N/A	60	0	10	28	N/A	N/A	N/A	N/A	6	46
Life expectancy at birth (M/F years)	75	N/A	64/67	67/69	65.7	70 (66/74)	N/A	N/A	N/A	72.4	61
Literacy rate (%)	96	N/A	85	85	96–97	90	N/A	N/A	N/A	96.2	80

[a] Communication not in English
[b] Table for national circumstances not given
[c] Data provided in sections other than national circumstances

Table 13. Sectoral coverage of priority issues related to climate circumstances

	Farming	Energy	Forests	Waste management	Water	Transport	Coastal zones	Tourism
Argentina	N, I, M	N, I, M	N		I	N	I	
Armenia	N, I, A	M	N, I, A, M		I, A			
Federated States of Micronesia	N, I, A, M	M	N, A, M		N, I, A		I, A	N
Jordan	N, M	M	A, M	M	I, A	M		
Kazakhstan	N, I, A, M	N, M	N, M		I, A			
Mauritius	N, I, M	N, M	N, I, M	M		N, M	I	N
Mexico	N, I, A	N, I, M	N, I, M	M	N, I	M	I	
Republic of Korea	N, I, A, M	M	N, I, M	M	I	N, M	I	
Senegal	N, I	N, M	M	M		N, M	A	
Uruguay	N, I, A, M	M	M	M			I, A	N
Zimbabwe	N, I, A, M	N, M	I, A, M		I			

Notes:

N: National circumstances and development priorities
I: Impacts of climate change
A: Adaptation to climate change
M: Measures to address climate change

Table 14. Ongoing or planned research programmes on climate change impacts, vulnerability assessment and adaptation options

Adaptation and vulnerability areas	Socio-economic	Environment	Biodiversity	Forestry	Agriculture	Livestock	Fisheries	Water resources	Coastal zones	Human health	Cross-cutting issues
Climate change impacts/ vulnerability	MEX MUS URY	ARG MEX MUS SEN URY			MUS URY ZWE	MUS	URY	JOR URY	MUS	MUS URY	ARM, FSM KOR MEX URY ZWE
Adaptation options		ARM ZWE	ARM	ZWE	MUS URY ZWE	URY ZWE		ARM URY	FSM MUS URY	ZWE	ARM FSM

Table 15. Ongoing or planned research programmes on measures for addressing climate change

	Agriculture	Energy	Forestry	Waste management	Industry	Transportation	Cross-cutting issues
Research and development	ARM ZWE	KOR MUS ZWE	ARG	KOR	KOR MEX URY ZWE	MUS	FSM KOR MUS URY
Applied research	ARM MUS ZWE	ARG ARM JOR KAZ KOR MUS ZWE	KOR ZWE	KOR	ARM	URY	ARM KOR
Demonstration projects	ARG	ARG ARM					ARM
Technology assessment and transfer	ARG ARM ZWE	KOR URY ZWE			ARM KOR URY ZWE		KOR MEX URY
Other/not specified			ARG ARM				FSM MEX

Table 16. Equipment and arrangements for systematic observation

Network of stations								Maps	Satellite	Radar	Aeronautical	Databank	Statistics	Research
GHG observation stations	Climatic stations	Meteorological stations	Rainfall stations	River stations	Lakes stations	Sea stations	Other stations not specified							
ARG	ARM KAZ KOR	ARM KOR MUS ZWE	ZWE	ARM	ARM	MUS KOR	ARG KAZ KOR MEX MUS	ARM	KOR MUS ZWE	KOR ZWE	KOR MUS	ARG KAZ MUS URY ZWE	ARM	ARG ARM KAZ KOR MEX MUS URY

Table 17. Regional and international cooperation for systematic observation

	REGIONAL	INTERNATIONAL
Argentina	- Regional network for observation of greenhouse gases including ozone and UV-B radiation - in cooperation with Uruguay and Paraguay installation of stations in the "Southern Cone" region. - Regional databank on meteorological and environmental data.	- Global observation of greenhouse gases including Ozone: working in cooperation with International Atomic Energy Agency, Max Planck Institute and CIRES (France). - Participation in global networks and "cooperative projects" under the World Meteorological Organization (WMO). - Financial assistance from the European Union for research on river hydrology and on and on the development of climate numerical models.
Armenia	- Interstate Council of the Commenwealth of Independent States on Hydrometeorology	- Participation in global networks and "cooperative projects" under the WMO, in particular assistance by Meteo France to access RETIM-AEROMET system, which enables meteorological data and maps to be received through data from the geostationary satellites - and CLICOM system of climactic data reception and service. - Exchange of information and data for publications (Germany and Japan) and for use on general circulation models.
Kazakhstan		- Participation in global networks and "cooperative projects" under the WMO, including World Climate Programme (WCP) - Assistance from UNEP and WMO for climate change monitoring - Assistance from USCSP for preparing climate change scenarios using GCM
Mauritius		- Participation in international activities of WMO, UNEP and IPCC. - Financial assistance from the United States Country Studies Program for use of aerial video-tape-assisted vulnerability analysis
Mexico	- Regional research within the Inter-American Institute for Global Change Research	

Table 17. (continued)

Republic of Korea	- Observation and analysis of Asian monsoon and global water cycles - Korean-Chinese meteorological cooperation agreement in 1994 for technological cooperation on telecommunication systems and Global Air Watch - Korean-Japanese Science and Technology Committee - development of weather forecast system for the Korean Peninsula. - Meteorological cooperation with Australia	- Participation in the Global Environment Monitoring System (GEMS) managed by UNEP and WHO. - Participation in global networks and "cooperative projects" under the WMO, in particular Global Air Watch (GAW), Global Climate Observing System (GCOS) and World Climate Programme (WCP). - Participation in the Global Ocean Observing System (GOOS) coordinated by the Intergovernmental Oceanographic Commission of UNESCO. - Participation in the Global Energy and Water Cycle Experiment (GEWEX) - Participation in GCTE (Global Change and Terrestrial Ecosystems Project), LUCC (Land Use and Land Cover Change), AMIP (Atmospheric Model Intercomparison Project), PMIP (Paleo-climate Modelling Intercomparison Project), CMIP (Coupled Models Intercomparison Project), START/TEACOM
Uruguay	- Regional research within the Inter-American Institute for Global Change Research	- Participation in global networks and "cooperative projects" under the World Meteorological Organization (WMO), including Global Air Watch (GAW), Global Climate Observing System (GCOS), World Weather Watch (WWW). - Financial assistance from the European Union for research on river hydrology and on the development of climate numerical models.
Zimbabwe	- Hosts the Southern Africa Development Community (SADC) Regional Drought Monitoring Centre in cooperation with the SADC Early Warning System for Food Security	

Note:

START/TEACOM : Global Change System for Analysis, Research and Training Regional Research Committee for Temperate East Asia

Table 18. Public awareness activities and material

Area	Pamphlets/ brochures	Newsletters	Articles/ publications	Information kits	Teaching material	CD-ROM	Internet	Audiovisual material	Radio	Television	Public talks/ open lectures	Expositions
Climate change	ARM FSM URY		ARM MEX URY ZWE		FSM URY		ZWE		ARM	ARM	ARM MEX URY	URY
Environment	MUS	KOR MUS	MUS	MUS	MUS	MUS	MUS	MUS	MUS	MUS	MUS URY ZWE	
Energy	JOR KOR		KOR					KOR		JOR KOR	KOR	KOR

Table 19. Financial and technological needs and constraints related to the assessment of vulnerability

Areas of vulnerability	Activities
Cross-cutting	**Argentina**: Development of emission scenarios **Armenia**: Upgrading and maintenance of observation network and research on hydrometeorology and climatology Establishment of a regime for monitoring vulnerable ecosystems **Federated States of Micronesia**: Complete vulnerability studies in all relevant sectors and other needs assessment studies **Jordan**: Upgrade renewable energy centre to become a regional training centre Identify vulnerable areas and adaptive responses **Kazakhstan**: Establishment of climate change monitoring system **Mauritius**: Training in predictive modelling and interpretation of models for constructing climate change scenario Use of geographic information system (computer mapping) Research into sea-level rise and temperature relationship and impact on socio-economic sectors **Senegal**: Compilation of data for vulnerability assessments **Uruguay**: Complementing previous vulnerability studies to identify strategies and impacts on the economy, health and environment Conduct studies into hydropower resources, fisheries and health Digitalization of information Continued long-term monitoring and definition of standard criteria for data collection and processing **Zimbabwe**: Conduct studies on vulnerability (energy, ecosystems and human settlements) Extension of research programmes (inclusion of, *inter alia*, population at risk, severity of impact, economic losses and ecosystem damage) to assist decision makers

Table 19. (continued)

Agriculture	**Mauritius:** Research into the impact of climate change on crops and animal production, effects of CO_2 fertilization on crop growth, development and productivity; modelling of climate-vegetation interactions and effects of microorganisms on soil processes **Senegal**: Investigation into the impacts of climate change on agriculture and food security
Human health	**Mauritius:** Research into the effect of ozone concentration levels on health Research into human tolerance and physiological responses to climate factors **Zimbabwe**: Study impacts on human health
Marine products	**Mauritius**: Data gathering for assessment of stocks, sustainable yield and depletion Collection of data on ocean circulation changes (temperature and sea-level rise) via satellite (remote sensing) Participation in research on optimal temperature ranges for pelagic fish
Water resources	**Jordan**: Estimation of impact on water resources (identification of vulnerable areas, impacts and adaptive responses), investigate changes in the three major catchments **Mauritius:** Measurement, mapping and computer modelling of ground-water lenses for atolls

Table 20. Financial and technological needs and constraints related to adaptation

Areas of adaptation	Activities
Cross-cutting	**Armenia:** Implementation of measures to facilitate adaptation to the adverse consequences of climate change **Federated States of Micronesia:** Research to be conducted in the following areas: Documentation of traditional Micronesian knowledge of environmental management systems for future application Design of evaluation component into each adaptation measure which is implemented Strengthen regional networks to facilitate transfer of technology to develop adaptation and other measures Public awareness programmes Promotion of methods of coping with anticipated impacts of *El Niño* events **Jordan:** Identification of adaptation needs and actions under the national environmental action plan, including capacity-building for environmental management **Kazakhstan:** Identification of priority areas for continuation of work on adaptation Full implementation of adaptation measures will require substantial investment over a long period of time Establishment of systematic observation system **Mexico:** Successful implementation of adaptation measures will depend on access to technology and financial support as well as information exchange **Senegal:** Studies to understand consequences of CO_2 concentration in relation to adaptation measures **Uruguay:** Studies to identify adaptation measures and strategies in relation to the economy, fisheries, hydro resources, health and environment Methods to meet adaptation and mitigation objectives Promotion of sustainable development goals **Zimbabwe:** Studies on adaptation (energy, ecosystems and human settlements); Enhancing capacity in present research institutions for studies on population at risk, severity of impact, economic losses and ecosystem damage
Coastal zone management	**Federated States of Micronesia:** Development of coral reef protection programmes (marine protected areas, protection against over-exploited reef fishery stocks) Adequate waste management (solid waste, industrial and human sewage) to protect the coastal ecosystems Mangrove reforestation **Mauritius:** Research into the costs and advantages of protection for coasts and beach replenishment using offshore sand; optimal temperature ranges for pelagic fish Study on the effect of sewage outfalls on coral reefs
Forestry	**Jordan**: Preservation of forest lands, range land development

Table 20. (continued)

Water resources	**Armenia:** Setting up of monitoring regimes for water resources Ensuring rational use of water in all branches of the economy Saving water by means of reconstruction and application of advanced methods of irrigation Building reservoirs to increase accumulation of winter and spring river flow by 2 billion m^3 **Federated States of Micronesia:** Ensure adequate supply of fresh potable water on a continuous basis to limit damage from *El Niño* and *La Niña* events, e.g. construction of a suitable water system infrastructure, solar desalination systems and off-roof rainwater catchments **Jordan**: Building capacity for the operation and maintenance of waste-water treatment plants Improve domestic water and irrigation network, implement waste-water reuse programmes Use of modern technology in the water resources sector **Kazakhstan**: Use of modern technology in the water resources sector **Mauritius:** Implementing measures aimed at achieving efficient water resources management (encourage reuse for secondary household uses, limitations on the use of water for crop irrigation, mass construction of household back-up rain catchment tanks) **Zimbabwe:** Increase in capacity of dams Research into improvement of groundwater storage Use of modern technology in the water resources sector
Other sectors	**Armenia**: <u>Natural ecosystems:</u> - Creation of optimum landscape zones and reserves to protect endangered species - Preservation of a gene fund for most vulnerable species and gene material in seed banks Human health: social, sanitary, preventive and administrative measures

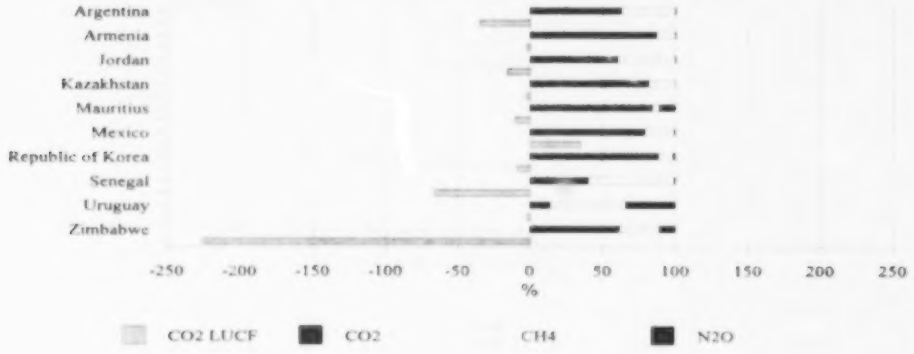
Table 21. Financial and technological needs and constraints related to addressing climate change

Sectors	Activities
Cross-cutting	**Armenia:** Voluntary emission limitations commitments would be undertaken if assistance is provided Cooperation is required in the reduction of GHG emissions in all sectors (energy, industry, agriculture, forestry and waste management) **Jordan**: Funding is required for the implementation of the following: Development of a national information system Preparation of an inventory, and assessment of, available environmentally sound technologies Testing of monitoring system under field conditions for the operation of installed solar and wind energy technology systems **Uruguay**: Access to technologies and information on reducing or preventing GHG emissions. Improvement of a legal framework to ensure adequate transfer of technologies and know-how. **Zimbabwe**: Capacity-building and training for various practitioners in the public sector on new policies for climate change and, related to energy pricing, analysis of use of incentives and regulations, and planning for agricultural and other natural resource based sectors Enhancing private sector participation in mitigation approaches
Agriculture	**Jordan:** Implementation of research and development programmes to attain sustainable agriculture **Uruguay**: Sectoral studies on integrated plans to manage agricultural areas and farming Development of options and implementation of programmes in the farming sector
Energy and residential/ commercial	**Armenia**: Introduction of energy efficiency and energy-saving measures in heat supply, in the municipal and commercial sectors **Kazakhstan**: Implementation of energy-saving measures. **Mauritius**: Research into renewable energy sources Hardware, training, and access to and adoption of renewable energy technologies **Uruguay**: Sectoral studies on how to remove obstacles hampering the adoption of mitigation measures, such as market obstacles to renewable energy penetration incentive mechanisms Implementation of energy efficiency improvements Developments of improved insulation standards for buildings **Zimbabwe**: Introduction of solar photovoltaic technology for pumpsets and domestic biogas digesters in rural areas; increased use of solar hot water systems

Table 21. (continued)

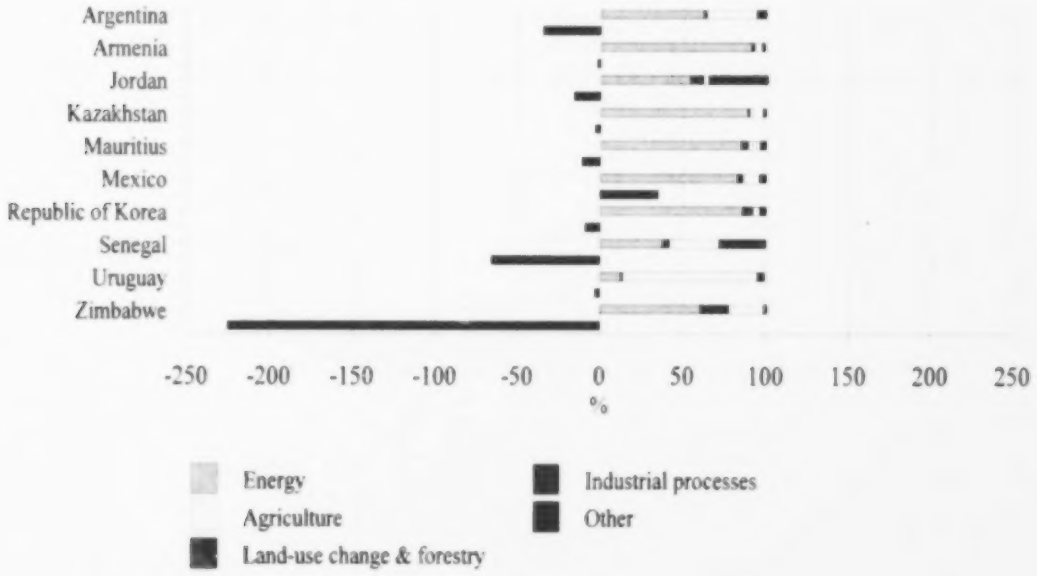
Waste management	**Mauritius**: Investigation into the establishment of power plants, the effect of sewage outfalls on the coral reefs (longer pipes to protect coral reefs) Introduction of waste reduction measures through education on recycling and composting
Industry	**Uruguay**: Implementation of studies to remove obstacles to the implementation of mitigation measures
Other sectors	**Federated States of Micronesia**: Conservation of coral reefs **Jordan:** Reduction of methane emissions from waste through recovery and use **Uruguay:** Studies related to integrated plans to manage coastal areas and hydro resources

Figure 1. Distribution of aggregate GHG emissions by gas, 1994



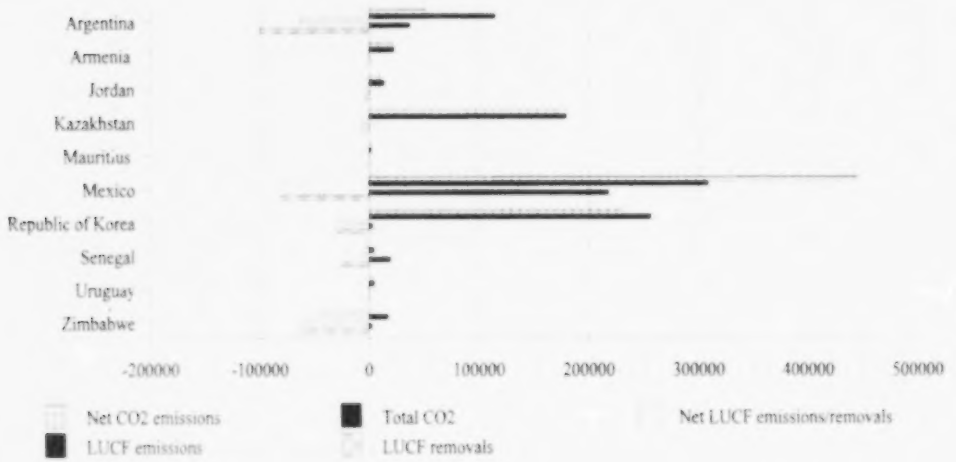
Note: For Armenia, Mexico and the Republic of Korea, data are for 1990. For Mauritius data are for 1995.

Figure 2. Sectoral distribution of aggregate GHG emissions, 1994



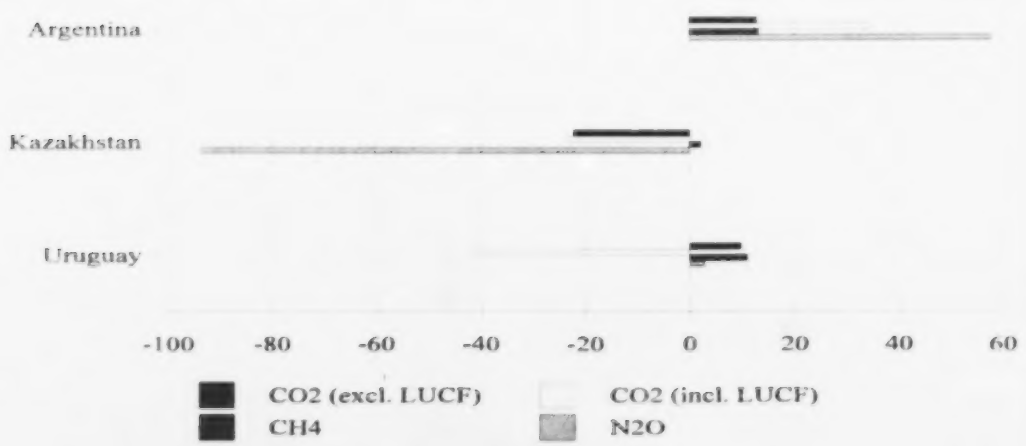
Note: For Armenia, Mexico and the Republic of Korea, data are for 1990. For Mauritius data are for 1995.

Figure 3. Net CO_2 and total CO_2 emissions compared to CO_2 emissions and removals from land-use change and forestry, 1994



Note: For Armenia, Mexico and the Republic of Korea data are for 1990. For Mauritius data are for 1995.

Figure 4. Percentage change in CO_2, CH_4 and N_2O emissions, 1990-1994



Annex

INVENTORIES AND PROJECTIONS - TABLES, 1990 AND 1994

General notes

1. Numerical data on inventories of GHG emissions and removals as well as on projections are included in the tables below. The inventory tables contain information provided by the 10 non-Annex I Parties that officially submitted inventory data[25] in their initial national communications or updates to those communications[26].

2. The inventory tables (A.1 to A.8) provide information for both 1990 and 1994, as reported by the Parties, or for 1995 (Mauritius) in a consistent and comparable manner for individual non-Annex I Parties, although varying in the degree of coverage in various tables. This is due to differences in the coverage of years and sectors in the national communications.

3. The tables provide inventory data on a gas-by-gas basis for CO_2, CH_4, N_2O, and the ozone precursors (CO, NO_x and NMVOC), and include information on international bunkers. Information on *land-use change and forestry* is both included in CO_2 and aggregate estimates and presented separately from other CO_2 estimates, in order to facilitate a consistent and comparable presentation of the data. To present aggregate greenhouse gas emissions in a comparable manner the secretariat has used IPCC 1995 global warming potentials (GWPs) to present information in CO_2 equivalent[27].

4. Numerical data on projected CO_2, CH_4 and N_2O emissions are given in tables B.1 and B.2. The tables present projected GHG emissions for the years 2000 and 2010, as these two years were the most commonly reported. The decrease or increase in projected emissions is presented as a percentage in relation to 1990 data, where available.

5. Figures may differ from those reported in the national communications as a result of rounding during data input and processing, corrections of typographical and calculation errors or omissions, and the presentation (for consistency and comparability) of subtotals and totals not provided in the national communication. Some differences are also due to the fact that, in striving to ensure consistency and comparability, the secretariat has had to convert some of the estimates reported so that they concur with the format of the current IPCC Guidelines for the reporting of greenhouse gas emissions. The footnotes and notes to the tables should be treated as an integral part of the tables.

Explanatory notes

6. Blanks in the tables signify an absence of quantitative information. The secretariat has chosen to leave the spaces blank in order not to complicate the reading of the tables. The figure "zero" appears in the table only when reported as such by Parties. Categories of sources of GHG emissions or their sinks corresponding to the IPCC Guidelines nomenclature are given in *italics*.

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[25] The Federated States of Micronesia are not included in this annex, as the national communication did not include a GHG emission inventory.

[26] Argentina presented final inventories of greenhouse gases for 1990 and 1994 in a report on climate change in Argentina. Jordan provided an update of its national communication. Uruguay submitted a 1994 inventory and a comparative study of net greenhouse gas emissions for 1990 and 1994.

[27] It should be noted that six out of the ten reporting Parties provided CO_2 equivalent estimates.

Table A.1. Aggregate emissions and removals of CO_2, CH_4 and N_2O in CO_2 equivalent[a] by major source/sink category, including and excluding *land-use change and forestry*, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy		Industrial processes		Agriculture		Other[b]		Total (exluding LUCF)[c]	Land-use change and forestry[d]	Total (including LUCF)[e]	Percentage of LUCF in total GHG[f]
1990	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**(Gg)**	**(Gg)**	**%**
Argentina	99 460	62.0	3 058	1.9	51 399	32.0	6 489	4.0	160 407	-63 347	97 060	-39.5
Armenia	23 108	91.3	630	2.5	1 039	4.1	536	2.1	25 312	- 617	24 695	-2.4
Jordan												
Kazakhstan	245 927	91.0	4 349	1.6	17 493	6.5	2 376	0.9	270 145	-4 011	266 134	-1.5
Mauritius												
Mexico	320 947	82.6	11 621	3.0	39 463	10.2	16 727	4.3	388 758	135 857	524 615	34.9
Republic of Korea	248 545	85.9	17 617	6.1	12 889	4.5	10 406	3.6	289 457	-26 235	263 222	-9.1
Senegal												
Uruguay	3 641	13.2	230	0.8	22 627	81.8	1 155	4.2	27 654	1 972	29 627	7.1
Zimbabwe[g]												
Total	941 629	81.1	37 505	3.2	144 909	12.5	37 689	3.2	1 161 733	43 620	1 205 353	3.8
1994												
Argentina	111 854	61.7	4 257	2.3	54 467	30.0	10 718	5.9	181 296	- 63 347	117 949	-34.9
Armenia[h]	3 278	70.8	53	1.1	824	17.8	475	10.3	4 629	-26	4 604	-0.6
Jordan	11 844	53.8	1 701	7.7	562	2.6	7 890	35.9	21 996	- 3 548	18 448	-16.1
Kazakhstan	196 027	89.4	1 014	0.5	17 388	7.9	4 811	2.2	219 239	- 6 627	212 612	-3.0
Mauritius (1995)	1 760	85.4	88	4.3	139	6.8	72	3.5	2 060	- 221	1 839	-10.7
Mexico												
Republic of Korea												
Senegal	3 789	38.3	346	3.5	2 958	29.9	2 805	28.3	9 896	- 6 576	3 321	-66.4
Uruguay	3 971	13.3	279	0.9	24 277	81.4	1 288	4.3	29 815	- 865	28 950	-2.9
Zimbabwe	16 759	60.7	4 593	16.6	5 715	20.7	558	2.0	27 624	- 62 269	- 34 645	-225.4
Total	349 280	70.3	12 330	2.5	106 329	21.4	28 616	5.8	496 556	- 143 479	353 077	-28.9

[a] Aggregate emissions of CO_2, CH_4 and N_2O in terms of CO_2 equivalent using 1995 IPCC global warming potentials.
[b] Includes *waste* and non-CO_2 (CH_4 and N_2O) *land-use change and forestry* emissions.
[c] Sum of aggregate GHG emissions (CO_2, CH_4 and N_2O in CO_2 equivalent) from all sectors, excluding CO_2 *land-use change and forestry* emissions /removals. This total is set at 100 per cent in this table.
[d] Total net CO_2 emissions or removals from *land-use change and forestry*.
[e] Sum of aggregate GHG emissions (CO_2, CH_4 and N_2O in CO_2 equivalent) from all sectors, including CO_2 *land-use change and forestry* emissions /removals.
[f] Percentage increase or decrease in aggregate GHG emissions with the inclusion of *land-use change and forestry*.
[g] The Party also reported *energy* GHG emission estimates for 1990 (19 134 Gg).
[h] The Party reported 1994 estimates in CO_2 equivalent, which are given in this table.

Table A.2. Anthropogenic CO_2 emissions and removals by source/sink category, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Fuel combustion [a]		Industrial processes		Other [b]		Total (excluding LUCF) [c]	Land-use change and forestry [d]	Total (including LUCF) [e]	Percentage of LUCF in total CO_2 [f]
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	(Gg)	(Gg)	%
Argentina	97 402	96.1	2 994	3	915	0.9	101 312	-63 347	37 965	-62.5
Armenia	21 383	97.1	630	2.9			22 013	- 617	21 396	-2.8
Jordan										
Kazakhstan [g]	226 040	98.1	4 349	1.9			230 389	- 4 011	226 378	-1.7
Mauritius										
Mexico	297 011	96.2	11 621	3.8			308 632	135 857	444 489	44.0
Republic of Korea	238 990	93.2	17 512	6.8	11	0.0	256 513	- 26 235	230 278	-10.2
Senegal										
Uruguay	3 608	93.0	230	6.0			3 838	1 972	5 810	51.4
Zimbabwe [h]										
Total	884 433	95.9	37 336	4.0	926	0.1	922 696	43 620	966 316	4.7
1994										
Argentina	109 001	95.5	4 208	3.7	1 111	1.0	114 320	-63 347	50 973	-55.4
Armenia										
Jordan	11 659	87.3	1 701	12.7			13 360	3 548	9 842	-26.5
Kazakhstan [g]	178 252	99.4	1 014	0.6			179 265	-6 627	172 638	-3.7
Mauritius (1995)	1 737	99.9	2	0.1			1 738	- 221	1 517	-12.7
Mexico										
Republic of Korea [i]										
Senegal	3 660	91.4	346	8.6			4 006	-6 576	-2 570	-164.2
Uruguay	3 930	93.4	279	6.6			4 210	- 865	3 344	-20.6
Zimbabwe	14 772	86.4	2 316	13.6			17 088	-62 269	-45 181	-364.4
Total	323 041	96.7	9 866	3.0	1 111	0.3	334 017	-143 453	190 564	-42

[a] For further details on *fuel combustion* see table A.3.
[b] Includes *fugitive fuel* emissions, *agriculture* and *waste*.
[c] Sum of CO_2 emissions from all sectors, excluding CO_2 *land-use change and forestry* emissions/removals. This total is set at 100 per cent in this table.
[d] Total net CO_2 emissions or removals from *land-use change and forestry*.
[e] Sum of CO_2 emissions from all sectors, including CO_2 *land-use change and forestry* emissions/removals.
[f] Percentage increase or decrease in total CO_2 emissions with the inclusion of *land-use change and forestry*.
[g] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, CO_2 emissions caused by carbide production in the *industrial processes* sector were not included in the 1994 inventory. Nevertheless, total emissions and emissions from the main categories were reported to be quite comparable.
[h] The Party also reported an *energy* CO_2 emission estimate for 1990 (16 750 Gg).
[i] The Party also reported a CO_2 *fuel combustion* estimate for 1994 (342 746 Gg).

Table A.3. Anthropogenic CO_2 emissions from fuel combustion, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy industries		Industry		Transport		Small combustion[a]		Other[b]		Tota
1990	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg)**	**%**	**(Gg**
Argentina	29 494	30.3	18 906	19.4	27 516	28.2	21 486	22.1			97
Armenia	11 333	53.0	2 138	10.0	3 635	17.0	3 849	18.0	428	2.0	21
Jordan											
Kazakhstan[c]	94 211	41.7	48 187	21.3	32 471	14.4	31 171	13.8			226
Mauritius											
Mexico	108 473	36.5	64 971	21.9	94 706	31.9	28 861	9.7			297
Republic of Korea	37 934	15.9	87 282	36.5	42 198	17.7	64 592	27.0	6 985	2.9	238
Senegal											
Uruguay	506	14.0	604	16.7	1 481	41.0	1 003	27.8	14	0.4	3
Zimbabwe[d]											
Total	281 951	31.9	222 088	25.1	202 006	22.8	150 961	17.1	7 427	0.8	884
1994											
Argentina	32 186	29.5	17 000	15.6	34 878	32	24 937	22.9			109
Armenia											
Jordan	5 306	45.4	1 616	13.8	2 798	23.9	1 969	16.8			11
Kazakhstan[c]	74 043	41.5	52 262	29.3	15 097	8.5	30 704	17.2	6 145	3.4	178
Mauritius (1995)	656	37.7	278	16.0	645	37.1	148	8.5	10	0.6	1
Mexico											
Republic of Korea	76 378	22.3	127 703	37.3	71 040	20.7	62 648	18.3	4 977	1.5	342
Senegal			1 623	44.3	1 233	33.7	804	22.0			3
Uruguay	125	3.2	499	12.7	2 177	55.4	1 108	28.2	22	0.6	3
Zimbabwe	7 028	47.6	2 397	16.2	1 851	12.5	3 496	23.7			14
Total	195 721	29.4	203 377	30.5	129 719	19.5	125 814	18.9	11 154	1.7	665

[a] Includes emissions from the source/sink categories: *commercial/institutional*, *residential* and *agricultural/forestry/fishing*.

[b] Includes emissions from all other non-specified *fuel combustion* except from the combustion of *biomass*.

[c] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, 1990 CO_2 emissions from *industry* were underestimated due to lack of information on individual source categories, while transport emissions were reported to be overestimated in 1990. Nevertheless, total emissions and emissions from the main categories were reported to be quite comparable.

[d] The Party also reported a total *energy* CO_2 emission estimate for 1990 (16 750 Gg).

Table A.4. Anthropogenic CO_2 emissions and removals[a] from land-use change and forestry by subcategories, 1990 and 1994 (Gigagrams and percentage of total flux from land-use change and forestry[b])

1990	Changes in forest and other woody biomass stock		Forest and grassland conversion		Abandonment of managed lands		Other		Total net emissions or removals
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Argentina	- 31 809	23.2	36 844	26.9	- 68 382	49.9			- 63 347
Armenia	- 617	100.0							- 617
Jordan									
Kazakhstan	- 4 627	88.3	616	11.7					- 4 011
Mauritius									
Mexico	31 552	10.5	217 734	72.7	- 50 325	16.8			135 857
Republic of Korea	- 26 235	100.0							- 26 235
Senegal									
Uruguay[c]	1 972	100.0							1 972
Zimbabwe									
1994									
Argentina	- 31 809	23.2	36 844	26.9	- 68 382	49.9			- 63 347
Armenia[d]									
Jordan	- 249	5.8	- 374	8.7	- 832	19.4	- 2 841[e]	66.1	- 3 548
Kazakhstan	- 6 627	100.0							- 6 627
Mauritius (1995)	- 221	100.0							- 221
Mexico									
Republic of Korea									
Senegal	- 25 820	57.3	19 245	42.7					- 6 576
Uruguay[c]	- 865	100.0							- 865
Zimbabwe	- 64 769	96.3	2 500	3.7					- 62 269

[a] Negative values in Gg denote removal of CO_2. Positive values denote a net source of emissions.

[b] The given percentages represent the proportion of emissions and removals of this category in relation to the sum of the absolute values of the net emissions in each category. For example, the percentage figure for changes in forest and other woody biomass stocks for Argentina is 31 809/(31 809 + 36 844 + 68 382)*100= 23.2.

[c] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, the 1994 inventory does not include *forest and grassland conversion* estimates. Nevertheless, total emissions and emissions from the main categories were reported to be quite comparable.

[d] The Party also provided estimates from CO_2 emissions and removals from soil, but reported them separately from others land-use change and forestry estimates and did not include them in the net national totals of CO_2, as the uncertainty associated with the default factors used could be significant. This sub-sector was estimated to account for a CO_2 removals of 3357 Gg and 3808 Gg in 1990 and 1994, respectively. If these estimates were included in net national CO_2 totals, the Party showed to be a net sink of CO_2 in 1994.

[e] The Party reported a *land use change and forestry* estimate in CO_2 equivalent for 1994 (-26 Gg).

[f] The Party reported CO_2 emissions and/or removals from soils.

Table A.5. Anthropogenic CH_4 emissions by source category, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy				Agriculture						Waste		Other[a]		Total
	Fugitive fuel		Fuel combustion		Livestock[b]		Rice cultivation		Other[c]						
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Argentina	31	1.1	14	0.5	2 351	84.0	80	2.9	10	0.4	309	11.0	3	0.1	2 799
Armenia	80	52.4	0	0.2	47	30.6			0	0.2	26	16.7			15
Jordan															
Kazakhstan[d]	904	48.5	12	0.6	775	41.6	58	3.1			112	6.0	1	0.1	1 862
Mauritius															
Mexico	1 040	28.5	42	1.1	1 749	48.0	35	1.0	9	0.3	526	14.4	241	6.6	3 642
Republic of Korea	246	18.1	17	1.2	185	13.6	414	30.4			495	36.3	5	0.4	1 362
Senegal															
Uruguay	0	0.0	0	0.1	589	88.7	22	3.3	1	0.1	52	7.8			665
Zimbabwe[e]															
Total	2 301	22.0	85	0.8	5 697	54.3	609	5.8	20	0.2	1 519	14.5	250	2.4	10 482
1994															
Argentina	38	1.2	33	1.0	2 454	77.5	119	3.8	8	0.3	510	16.1	2	0.1	3 166
Armenia															
Jordan			2	0.4	25	6.2			2	0.4	376	93.0	0	0.0	404
Kazakhstan	843	44.3	2	0.1	759	39.9	69	3.6			229	12.0			1 902
Mauritius (1995)			1	11.1	1	14.8					3	74.0			5
Mexico															
Republic of Korea															
Senegal[f]	0	0.1	5	1.9	138	49.8			2	0.8	106	38.3	25	9.0	277
Uruguay	0	0.0	1	0.1	648	87.9	29	4.0	1	0.1	58	7.9			737
Zimbabwe	13	3.7	64	17.8	187	52.0			50	13.9	25	7.0	20	5.7	360
Total	894	13.1	107	1.6	4 212	61.5	217	3.2	63	0.9	1 308	19.1	48	0.7	6 849

[a] Includes source/sink categories: *industrial processes* and *land-use change and forestry*.
[b] Includes source/sink categories: *enteric fermentation* and *manure management*.
[c] Includes source/sink categories: *prescribed burning of savannas, field burning of agricultural residues* and *other*.
[d] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, part of the emissions from *oil and natural gas*, and emissions from *industrial waste water* were only reported for 1994, while CH_4 *transport* and *small combustion* emissions were only reported for 1990. Nevertheless, total emissions and emissions from the main categories were reported to be quite comparable.
[e] The Party also reported a total *energy* CH_4 emission estimate for 1990 (97 Gg).
[f] The Party indicated that emissions from *rice cultivation* were negligible.

Table A.6. Anthropogenic N_2O emissions by source category, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy				Industrial processes		Agriculture		Other[a]		Total
	Transport		Other[b]								
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Argentina	0.5	49.3	0.1	12.6			0.4	38.1			1.0
Armenia	0.0	7.3	0.1	36.2			0.2	56.4			0.3
Jordan											
Kazakhstan[c]	0.6	28.4	1.5	71.1					0.0	0.5	2.1
Mauritius											
Mexico	2.2	18.9	1.7	14.7			5.8	49.4	2.0	17.0	11.8
Republic of Korea	2.0	14.3	11.0	78.6			1.0	7.1			14.0
Senegal											
Uruguay	0.0	0.1	0.0	0.0			31.5	99.1	0.2	0.7	31.8
Zimbabwe[d]											
Total	5.4	8.8	14.5	23.8			38.9	63.7	2.2	3.6	61.0
1994											
Argentina	0.6	38.6	0.2	12.3			0.8	49.1			1.6
Armenia											
Jordan	0.1	20.0	0.3	77.5			0.0	2.5			0.4
Kazakhstan[c]			0.1	100.0							0.1
Mauritius (1995)	0.0	0.7	0.0	4.8	0.3	38.4	0.4	55.4			0.7
Mexico											
Republic of Korea											
Senegal[e]			0.0	12.9			0.0	18.5	0.2	68.5	0.2
Uruguay	0.1	0.2	0.0	0.0			32.4	99.1	0.2	0.7	32.7
Zimbabwe	0.6	5.8	0.6	6.4	6.1	62.8	2.4	24.8	0.0	0.1	9.6
Total	1.3	2.9	1.3	3.0	6.3	13.9	36.0	79.3	0.4	0.9	45.4

[a] Includes *land-use change and forestry* and *waste*.

[b] Includes *fugitive fuel emissions* and *fuel combustion* emissions other than *transport*.

[c] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, N_2O *energy and transformation industries*, *transport* and *small combustion* emissions were only reported for 1990. Nevertheless, total emissions and emissions from the main categories were reported to be quite comparable.

[d] The Party reported a total *energy* N_2O emission estimate for 1990 (1.1 Gg).

[e] The Party reported only N_2O emissions from biomass burning under *energy*.

Table A.7. Anthropogenic emissions of precursor gases, 1990 and 1994 (Gigagrams)

	CO	NO_x	NMVOC
1990	**(Gg)**	**(Gg)**	**(Gg)**
Argentina	1 863	541	294
Armenia	288	73	47
Jordan			
Kazakhstan	3 108	1 198	260
Mauritius			
Mexico	11 033	1 013	801
Republic of Korea	1 056	851	152
Senegal			
Uruguay [a]	300	30	38
Zimbabwe			
1994			
Argentina	1 979	623	348
Armenia			
Jordan			
Kazakhstan	57	165	
Mauritius (1995)[b]	67	10	15
Mexico			
Republic of Korea			
Senegal	311	9	
Uruguay [a]	353	39	46
Zimbabwe	1 946	77	

[a] The Party also reported SO_2 estimates for 1990 and 1994 (42 and 33 Gg, respectively).

[b] The Party also reported a SO_2 estimate (13 Gg).

Table A.8. Anthropogenic emissions of CO_2 from international bunkers, 1990 and 1994 (Gigagrams)

1990	(Gg)
Argentina	
Armenia[a]	405
Jordan	
Kazakhstan	
Mauritius	
Mexico	
Republic of Korea	7 140
Senegal	
Uruguay[b]	422
Zimbabwe	
1994	
Argentina	
Armenia	
Jordan	610
Kazakhstan	
Mauritius (1995)	670
Mexico	
Republic of Korea	16 100
Senegal	
Uruguay[c]	659
Zimbabwe	

[a] The Party also reported N_2O estimates from international bunkers (0.003 Gg).

[b] The Party also reported CH_4 and precursor estimates from international bunkers. For NO_x an estimate of 11 Gg was reported, while for the other gases, estimates were approximately zero.

[c] The Party also reported CH_4, N_2O and precursor estimates from international bunkers. For NO_x, CO and SO_2, estimates of 17, 1 and 6 Gg were reported, while for CH_4, N_2O and NMVOC, estimates were approximately zero.

Table B.1. Projected anthropogenic emissions of CO_2 until 2010 (Gigagrams)

	1990 [a]	1994/95 [a,b]	Percentage change relative to 1990	Projection and percentage change relative to the 1990 level			
				2000		2010	
	Gg	Gg	%	Gg	%		%
CO_2 (excluding *land-use change and forestry*)							
Armenia	22 013	4 492	-80	7 150	-68	11 960	-46
Kazakhstan [c]	94 211	74 043	-21	67 000	-29	93 000	-1
Mauritius (1995)	716	1 662	132	2 411	237	3 732	421
Republic of Korea [d]	238 632	370 026	55	543 510	128	794 220	233
Zimbabwe [e]		19 707				30 223	53
CO_2 *land-use change and forestry*							
Zimbabwe [f]		-62 269				-45 586	-27

[a] Differences between the inventory and the projection data were found for Mauritius, the Republic of Korea and Zimbabwe. This could be, for example, due to rounding, calibration of models, or that only a subset of the sources was projected.

[b] For Kazakhstan and Zimbabwe 1994 data are given in this column.

[c] Projections only refer to emissions from energy production (*energy industries*).

[d] Projections only refer to *fuel combustion* emissions. As projection data have been provided in carbon equivalent, the secretariat converted projection estimates to equivalent CO_2 emissions.

[e] Projected emissions are presented in relation to 1994 data. The Party provided separate projections for *energy* and *industrial processes*. Projection data given in this table represent the sum of projected emissions for these two sectors. For *land-use change and forestry*, projections given in this table represent the sum of emissions reported for land clearing, biomass removals and managed forests.

[f] Negative values in Gg denote removal of CO_2. Negative values in percentage denote less removals in 2000 and beyond than in 1990, or an increase in net emissions.

Notes

Armenia: Projections given here represent a "with measures" scenario. The energy demand is estimated for the most probable macroeconomic development scenario and corresponding energy consumption. *Fuel combustion* projections take into account the expected shifts in shares of the different fuel types (coal, gas, liquid) and measures (energy saving and efficiency, use of renewables) envisaged under the Energy Master Plan of Armenia, as well as use of nuclear energy. A scenario without nuclear energy was also provided.

Kazakhstan: Projections from the energy-producing sector given here represent a "baseline scenario" that assumes no mitigation measures to be implemented, recognizing that this scenario would not be consistent with long-term trends. Projections have been constructed using the ENPEP (Energy and Power Evaluation Program) model based on long-term socio-economic developments and the maximum energy demand projection. The Party also provided a graphical presentation of projected CO_2 emissions based on various mitigation options.

Mauritius: Projections given here represent a "business as usual" scenario.

Republic of Korea: Projections given here represent a "with measures" scenario, as they fully reflect the Government's energy plans (e.g. energy conservation and efficiency improvements, increased use of nuclear power). For the energy demand forecast, the LEAP (Long-range Energy Alternative Program) has been used. In the discussion of uncertainties, it was stated that projected GDP growth rates need to be adjusted according to recent economic developments. Other reported uncertainty factors are, *inter alia*, seasonal variations due to climate, economic and social conditions, fluctuation of energy prices and speed of developments in energy technologies.

Zimbabwe: Projections given here represent a "without measures" scenario, but it was assumed that there is an inherent improvement in productivity and energy efficiency as economies and technologies modernize. *Land-use change and forestry* projections were based on the assumption that the present relationship with land-use change will continue to the period up to 2030, when population growth and the cost of land will limit abandonment of land and engender more intensive agriculture.

Table B.2. Projected anthropogenic emissions of CH_4 and N_2O until 2010 (Gigagrams)

	1990	1994/1995 *	Percentage change relative to 1990	Projection and percentage change relative to the 1990 level			
				2000		2010	
CH_4	Gg	Gg	%	Gg	%	Gg	%
Armenia	152	79	-48	93	-38	129	-15
Zimbabwe **		282				477	69
N_2O							
Zimbabwe ***		8.4				14.3	69.2

* For Zimbabwe, data given in this column are for 1994.

** The projection figures do not include CH_4 *fuel combustion* and *fugitive fuel emissions*. As the Party provided separate CH_4 projections for *agriculture, waste, industrial processes* and *land-use change and forestry*, projection data given in this table represent the sum of projected emissions of those sectors.

*** The projection figures do not include N_2O *fuel combustion* emissions. As the Party provided separate N_2O projections for *industrial processes, agriculture* and *land-use change and forestry*, projection data given in this table represent the sum of projected emissions of those sectors.

Notes

Armenia: Projections of N_2O emissions were also made, but were included in aggregate GHG projections in CO_2 equivalent, and are therefore not presented in this table.

Zimbabwe: Projections for the *industrial processes* sector were reported to be rather uncertain, as there was no information on baseline trends in the technologies used in the industries of concern, nor was it possible to reasonably assume demand for the various products associated with the industrial sources of GHGs. Under these circumstances, it was assumed that, for emissions from these sectors, the present relationship to GDP would remain constant. In the *agricultural* sector it was assumed that agricultural practices are unlikely to change in the next 20 years and that emissions are likely to be pushed by population demand for food and the expansion of commercial crops rather than by major technological changes. CH_4 *waste* projections were based on population growth and urbanization rates.

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